FACTORY
MANAGEMENT and MAINTENANCE

January, 1935

L. C. MORROW
Editor

Plant Operation—1935 Model

AS WE enter 1935 it is in order to chart a course by which to carry out the year's details of plant operation.

Our first step is to take a sight to determine present position. Having steered among such currents and reefs as code formulation, price fixing, limitation of production, and 7(a), we need to know as nearly as possible where we stand.

From available indicators it is reasonably safe to make certain assumptions:

Codes of fair practice are to continue with us on some basis. Part of industry wants them continued in their present form. The report of the Joint Conference for Economic Recovery (National Association of Manufacturers and U. S. Chamber of Commerce) recommends that they be placed on a strictly voluntary basis by enactment of new emergency legislation for one year. The administration obviously is committed to codes.

Provisions concerning hours, wages, child labor, and collective bargaining free from coercion will remain as fundamental parts of codes. Nobody endorses child labor. There is no pronounced opposition to labor's being conceded the right to bargain for hours and rates, although, apparently, the Joint Conference recommends no such provision when an industry elects not to have a code.

There will be little price fixing. A considerable part of industry has long opposed it. Failure to satisfactorily control prices has convinced another part that the process is not feasible. Individuals high in the administration have taken their stand against it, notably S. Clay Williams and Senator Wagner.

The futility of trying to determine average industry costs for products of infinite variety is becoming apparent. So is the futility of trying to establish a definition of actual cost by which the right to sell below cost might be refused the individual manufacturer.

There will be diminishing support for the limitation of production. Except in a few cases, notably the textile and natural resource industries, there is little justification for limitation. As has been said often in these pages, our country does not have, cannot have, overproduction at the existing standard of living—for that matter, at a very much higher standard.

We may expect more than normal labor unrest. Certain test decisions are pending. Whichever way these decisions go, organized labor will attempt to capitalize them. If majority rule is to prevail in the individual plant, acquisition of the majority position will be attempted. If majority rule is not to prevail, the closed shop will be aimed at.

Paragraph 7(a) will not be revised quickly, in spite of a growing realization that eventually there must be prohibition of coercion of labor by labor as well as by employer. Employees themselves are coming to realize that nothing constructive can come from flying squadrons and similar intimidation.

It is not likely that Congress will pass legislation for a universal 30-hour week. There is nearly a unanimity of opinion concerning the setback to industry that would follow. The strongest labor leaders know that the proposal is not sound economically. Presumably they will make a show of fighting for it, desist without creating a major issue. However, watch Congress.

Some form of social legislation will be enacted. The masses have been primed for it, and cannot be let down. We do not know enough about unemployment insurance to legislate it into being, but we may do so anyway. Once embraced, we shall not be able to let go.

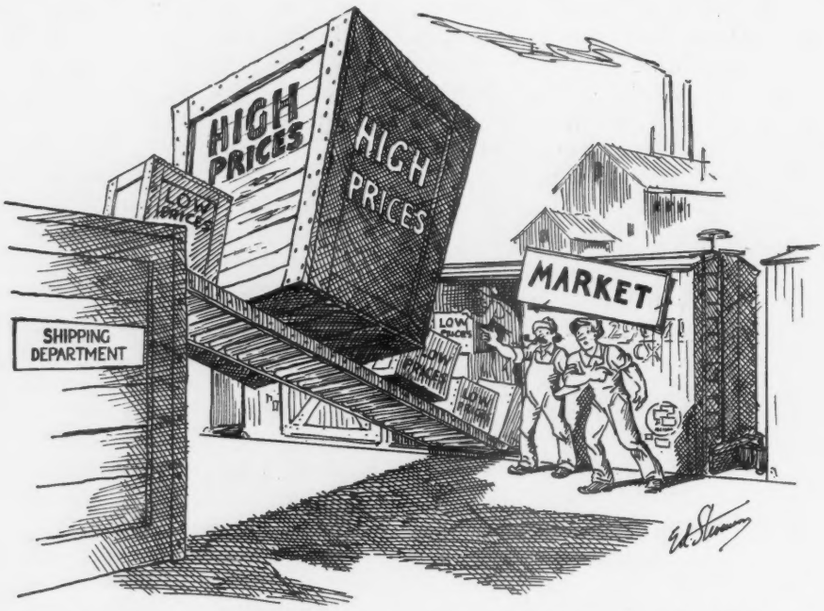
In a different category are old age pensions. They can be set up on an actuarial basis, probably should be the subject of our first attempt at social insurance. In any event, haste should be made slowly. Social insurance cannot be of aid to the present unemployed, can be put into effect in plenty of time for future use, even though we take time to study it. Luckily, there is indicated a recognition of the necessity to keep insurance and relief separate.

We shall see a pronounced trend toward concerted action by industry. In support of this statement we offer as evidence the recent cooperative undertaking of the National Association of Manufacturers and the U. S. Chamber of Commerce. It is remarkable that ninety men, representing widely diverging opinions and interests, could produce in three days a document representative of general industrial sentiment.

Very encouraging is the fact that the document itself is cooperative in tone, and suggestive rather than

dictatorial. It indicates a new spirit of compromise in industry. A decision of the group to carry on the work by means of a continuing committee is of great significance.

The combined effect of these indicators leads us to believe that the country as a whole is returning to the sane viewpoint that we must continue our industries on the basis of an economy of plenty rather than an economy of scarcity; that we must produce in order to have; that we must distribute our production widely; and that low prices are necessary to secure wide distribution.



"THAT BIG ONE WON'T GO THROUGH THE DOOR"

WHICH concludes our sight-taking, and brings us to charting for plant operation. Having recognized that wide distribution is largely dependent upon low prices, we see at once the influence of low cost of manufacture upon our whole prosperity set-up.

It is the cost of manufacture that the plant operating man controls. He exercises this control by means of certain tools at his command—tools that, for the sake of simplicity, we classify broadly as *Management* and *Maintenance.*

The effective use of these tools consists of employing the correct processes, procedures, and regulations of manufacture in correct sequence in an efficiently equipped, maintained, and serviced plant. Let us inspect the tools in some detail.

Assuming, for the moment, the existence of the right manufacturing equipment, properly serviced in the right buildings, the equipment must be so placed as to secure greatest output per unit of input (machine time, labor, supervision). The tool used is *Plant Layout.*

Because manufacturing is the changing of raw materials into finished product, the materials and products must be moved to, through, and from the equipment. The tool is *Materials Handling.*

What is the least store of raw materials that will permit sustained conversion? In what quantities shall it be fed to the converting equipment? To what standards shall the products be manufactured? To provide the answers there are called into use inventory control, scheduling and routing, quality control—giving, in combination, the tool *Production Control.*

What *have been* the costs of conversion? Cost records must be kept. What *will be* the costs? Standard costs must be set up. What of unit costs for plant maintenance, indirect labor, overhead? Budgeting will plan them in advance. The predicting, recording, and allocating of costs contribute *Cost Control.*

In planning layout, materials handling, production control, and cost control there must be the proper economy of time and motion with respect to equipment and labor. It is by use of the tool *Time and Motion Study* that this economy of plant operation is secured.

Even scientific determination of the best way to work, by means of time and motion study, may not result in greatest effectiveness unless the worker is given an incentive to induce good performance. The tool *Wage Incentives* is called into use.

And worker satisfaction is important. It is influenced by collective bargaining, unemployment insurance, old age pensions, safety, training—subjects with which the personnel department has to do. The tool is *Personnel Relations.*

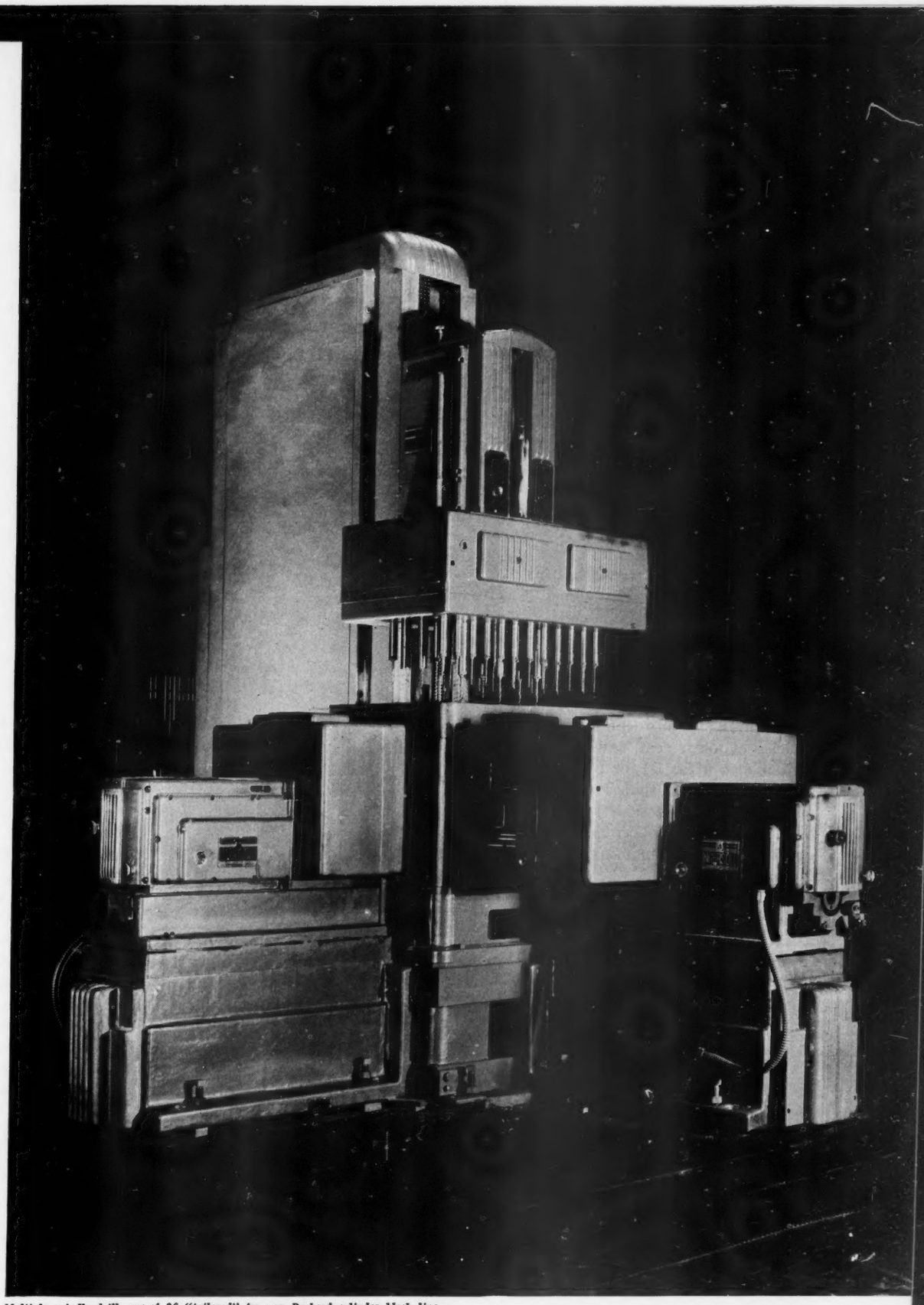
NOW TO get back to "the right manufacturing equipment, properly serviced, in the right buildings." Workers cannot function at their best with inadequate protection, lighting, heating, sanitation—and they cannot get the most out of their equipment.

Certain maintenance tools are called into use: *Power Generation and Supply, Electrical Distribution, Electrical Utilization* (by means of motors and controls, electron tubes, heating units), *Mechanical Power Transmission, Control of Process and Power Utilization* (by means of instruments), *Plant Services* (heating, air conditioning, water supply), *Welding, Building Upkeep, Repair.*

Unless these tools of maintenance are thoroughly understood and efficiently used, the tools of management are quite likely to be ineffective, because they are tools in the use of which a well-maintained plant with uninterrupted service is presupposed.

It is self-evident that there must be a master tool of maintenance. In *Factory* we call it *Maintenance Organization and Management.* It is just what the name implies—a coordination and direction of the many lesser tools of maintenance.

On the preceding bases of sighting and charting, plant operating men in industry should have a happy, a successful year in 1935.



Multiple spindle drill, one of 36 "tailored" for new Packard cylinder block line

More people buy more goods when prices are low. Prices are low when manufacturing costs are down. Manufacturing costs are down when plant operating men make effective use of the tools of management and maintenance at their disposal. The effective use of those tools presupposes correct processes, procedures, and regulations of manufacture in correct sequence in an efficiently equipped, maintained, and serviced plant

Problem: Too Much Plant

Answers by Packard

Revise layout to make possible same volume in half the space. Spend $6,200,000 to equip the other half for a new product

ALVAN MACAULEY
President, Packard Motor Car Company
Detroit

IF BUSINESS had continued to come at the rate it was coming in 1928 and 1929. . . . But of course it will not, for some years at least, in any business specializing in top-quality products which of necessity cost far more to produce than popular-priced articles which serve the pocketbook of a public weathering through its sixth year of shrunken incomes.

Even in plants producing articles of lower cost, and hence available to a far larger proportion of the public than Packard automobiles, this actuality must be faced. It is perhaps the greatest common denominator of industry.

Without going into the details of our problem—which, after all, is probably not greatly different in its essentials from the problems of thousands of established manufacturing companies throughout the United States—it is enough to say that we found ourselves with a considerable excess of factory space.

Old Order Changed

Changes in manufacturing processes—for instance, the use of lacquer instead of the old paint and varnish systems of painting—had released quantities of floor space, and general business conditions had added to this. We also had a considerable amount of equipment over and above that needed when operating at former peak capacities.

The major point is that times have changed. Although Packard is selling more than 40 per cent of all American automobiles in the fine car field—substantially as great a proportion as we sold in boom times—our production schedules have decreased.

"From our experience it is possible to make two general deductions that apply to many types of industry:

"First, it is comparatively simple to cut costs on the existing line of products by facing facts and condensing plant capacity into space adequate to meet probable production schedules of the next few years.

"Second, if a company has sufficient financial resources to do so, the opportunity is ready at hand to fill the space thus vacated with equipment far in advance of anything in the existing plant, *and to go ahead with producing a new line of products"*

As we took stock of the situation, it was evident that the time had come to revise our plant layout to take out the slack and cut those costs that can be reduced by condensing production departments into an area commensurate with manufacturing schedules.

So we set about this. We had been spread out on both sides of Grand Boulevard, Detroit, in a plant a mile long. A survey indicated that we could build the cars needed for our present demand in the buildings on one side of the street—about half of our manufacturing space.

When More Cars Are Built—

Part of this difference in schedules has come about not only through great savings in space effected by general development of production processes in the industry but through the shortening of factory hours. We used to work one shift 9 hours a day—which meant that if we should go to two shifts, we still could not approximate 24-hour operation. Now we are on a 5-day week, 7-hour day under the code. Three 7-hour shifts are much closer to a full day.

Likewise, when larger, more luxurious cars are once more in such demand that we shall have to go to three shifts, there will inevitably be such a shortage of labor that the 8-hour day will be established throughout the country—and this would permit running the factory 24 hours a day.

We began moving equipment into the buildings determined upon. And we found almost infinite possibilities of space saving to be had for the taking. Mind you, our plant has generally been credited with great efficiency. But viewed by 1934 standards there turned out to be a lot of slack which we had never seen in the halcyon days of long ago.

Departments that followed in

natural sequence had been pretty widely separated, both horizontally and vertically. We found it possible to shrink a lot of them into adjoining bays and buildings, so that many parts formerly moved on truck trains, by overhead chains, or along live-roll conveyors are now transferred from one department to the next by the simple expedient of handing them across from one bench to the next, or sliding them across on a six-foot chute.

Advantages of Relayout

There is no need to go into descriptions of the precise types of saving. They would doubtless vary widely in any two plants undertaking such a program. The point is, if our experience may be considered typical, that it is possible to pull operations together, decrease handling costs, take out slack, and do a better job of manufacturing at lower cost in the decreased space. Even though the vacated space remains idle, the advantages of the relayout might be worth while.

Just as an instance, the length of our assembly line has been greatly cut, the conveyor moves more slowly, workmen are closer together along the line.

But not all of the savings have come from reducing space between operations. The chassis is enameled on this line, and the enamel finish naturally must be baked on. Well, the old enameling ovens were very long indeed. Looking at them with eyes attuned to putting operations in the least possible space, we saw several ways in which we could cut down these ovens.

There used to be a long space at the beginning and likewise at the end, during which the chassis was subjected to little or no heat—and where little or nothing happened. These spaces were eliminated. The decreased speed of the conveyor chain proportionately decreased the length of the oven through which it moves. Lacking the exact figures at hand, it seems a safe estimate that the new enameling oven is about 30 per cent as long as the old one. Yet it does an identical job; there has been no scrimping anywhere.

Or consider our painting department. The old paint booths were of conventional design. Our new paint booths have glass sides in a room with a maximum of daylight, so that most of the time the spray-gun men operate by natural light of best quality. For the dark days and hours the department has artificial lighting as near to perfect as anything we have been able to discover.

No longer is the painter dependent on local light sources in his booth; instead, he has his local outlets merely supplementing the excellent lighting of the large room, which reaches him through the glass sides of his booth.

Obviously, enough paint flies around every day between cleanings so that the glass sides are not perfect mediums for transmitting light, but they are a big improvement over the old opaque walls. Better exhaust systems have kept this paint spray to the minimum.

With all this light, of course, the work is handled not only better but also quicker—which in turn means fewer paint booths.

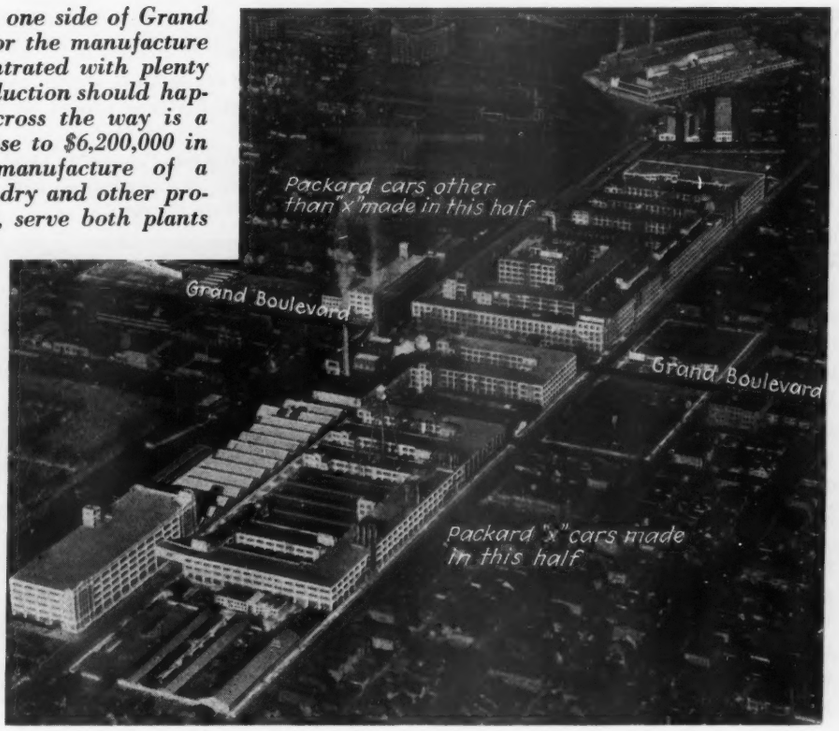
There were comparatively few places in the rearranged plant where new equipment was needed. After all, we have always kept our machinery and other equipment abreast of the times. But wherever there was an opportunity on predictable production schedules to make a substantial improvement or saving, we laid out the money.

Altogether, we are building a better automobile and as completely in about half the space we formerly required. And we can step up production to the old-time figures if and when such a need should happily arise, without materially increasing present space requirements.

The Real Story

What of the space vacated? That is the real story. Obviously, we could not show satisfactory earnings with half our plant vacant—and before this re-layout project had gone more than a few days, it was apparent to anyone that we were moving out of the buildings across the way, moving out for good and all.

As a matter of fact, we knew in advance that we were bound to get a tremendous amount of factory space made available, and have known for



One plant is now two plants. On one side of Grand Boulevard, production facilities for the manufacture of present lines have been concentrated with plenty of extra capacity if and when production should happily have to be stepped up. Across the way is a brand-new plant that contains close to $6,200,000 in brand-new equipment for the manufacture of a brand-new line of cars. The foundry and other production departments, upper right, serve both plants and all Packard cars

more than a year what we purposed doing with it.

For some months now we have to all practical purposes been setting up an absolutely new plant in those vacated buildings.

Altogether, as this is written in the autumn, we are embarked on a program of investing some $6,200,000, most of it on new equipment. Which, even back in 1929, would have been a lot of new equipment.

By the time this article is published, there will have been announced a new line of automobiles made by Packard to sell at prices far below anything Packard has ever offered to the public.

Frankly, we are determined to produce in this X-line (as we have been referring to it in the months before its announcement) a car at a moderate price well within reach of the broad automobile-buying public, which will be a materially better automobile than has ever been offered at any such price.

It Can Be Done

Nor is this merely a vague, hazy hope. We know that it can be done —that we are going to do it. And the reason we can do it lies in this plant across the street. It lies in the modern machinery and equipment which are right now going into that plant by carloads and truckloads.

Periodically one hears or reads something about the great strides that machine-tool makers and other equipment manufacturers have taken during the depression years.

To most of us, this progress has been of purely academic interest. Why get all hot and bothered about the accomplishments of the drill-press makers, as long as we had enough drill presses to bore three times as many holes as we needed? What use to marvel at a new machine for grinding all the cams of a camshaft at one time, if there were ordinary grinders in good condition lying idle?

But when we came to equipping the vacant factory space on the other side of the boulevard, our interest became direct and concrete. The reports, it developed, were not all exaggerated. Machine tools are available in many classes which can do better work, more accurate work, at higher speeds, at lower costs.

For example, we are having built right now, and before you read this there will be installed in our X-line plant, a battery of equipment which will bore and finish cylinder blocks in a shorter time than it has ever been done before. The saving, in man hours and machine hours, in floor space and all that goes with it, is very substantial.

Similar economies are showing up all through the new plant. It would be possible to fill this magazine with itemizations of these improvements. But you are not interested in a list of all our economies. What you need to know is that these economies can be accomplished today in practically every plant operation.

Nor are they only economies. Here and there appears on the X-line blueprints some machine which works with such accuracy that it puts old shop equipment to shame. Great precision was possible on our old equipment—and still is—by keeping machine maintenance up to the *n*th power, having operators of great skill, and then putting each finished piece through 100 per cent inspection at the hands of ruthlessly hard-boiled inspectors.

Nonchalant Precision

The new machine turns out one-ten-thousandth accuracy in the same nonchalant fashion as the old machine worked to one-thousandth. The saving in cost, in inspection, in rejections, cannot yet be determined to the tenth decimal place, but it will be substantial and worth while.

What this brand-new production equipment will mean in quality of product and value delivered to the automobile buyer can be only hinted at. This article has not been written for purposes of bragging about our new line. Rather it is contributed for its possible value to other manufacturers who may be faced by some such major problem as that which has confronted us. From our experience, it is possible to make a few general deductions which apply to many types of industry besides automobiles.

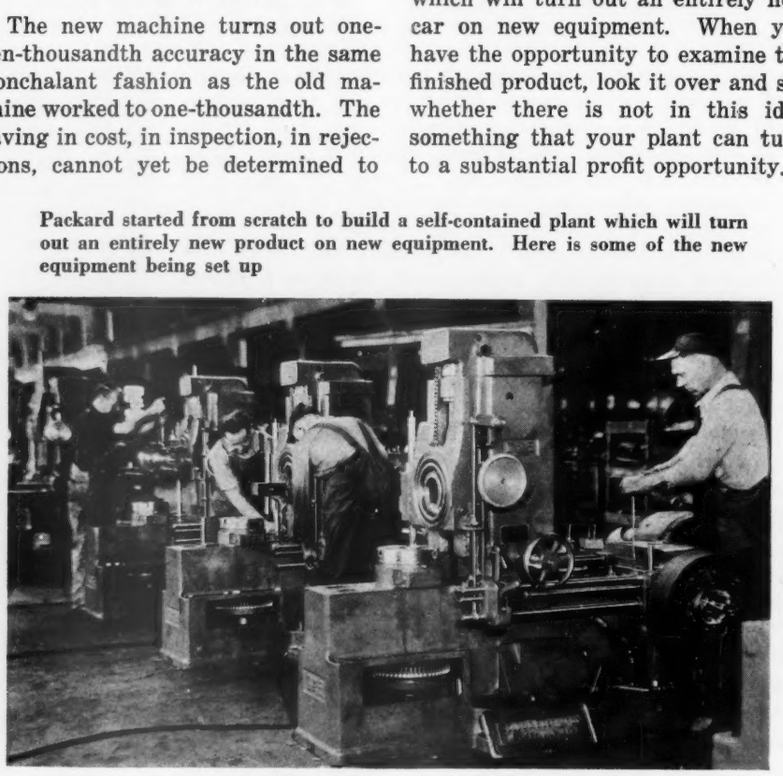
Two General Deductions

First, it is comparatively simple to cut costs on the existing line of products by facing facts and condensing plant capacity into space adequate to meet probable production schedules of the next few years.

Second, if a company has sufficient financial resources to do so, the opportunity is ready at hand to fill the space thus vacated with equipment far in advance of anything in the existing plant, and to go ahead with producing a new line of products.

Never before in the automobile industry has anyone started from scratch to build a self-contained plant which will turn out an entirely new car on new equipment. When you have the opportunity to examine the finished product, look it over and see whether there is not in this idea something that your plant can turn to a substantial profit opportunity.

Packard started from scratch to build a self-contained plant which will turn out an entirely new product on new equipment. Here is some of the new equipment being set up



When You Air Condition

You aim at one of two things—a better product, a better plant to work in—and you get both

C. E. DE VIVO

Plant Engineer, American Chicle Company
Long Island City, N. Y.

EITHER of two motives may be uppermost in management's decision to air condition a plant. It may be in order to regularize production, safeguard processes, insure quality of product. It may be simply a desire to make the plant a better place to work in.

Actually it makes little difference which motive prevails. The results are much the same.

Comfort First

For instance, a New Jersey concern that makes collapsible tubes for toothpaste conditioned its plant for no other reason than to provide comfortable working conditions. It happens that painting, printing, and lacquering are major steps in tube manufacture, and the management soon found that controlled temperature and humidity, not to mention clean, dust-free air, were responsible for a distinct pick-up in quality of product. (See pages 14 and 15.)

On the other hand, we approached the problem from the other angle. Frankly, the profit motives interested us most. We were thinking mainly of the effect of air conditioning on processes and products.

It so happened, however, that the conditions best suited for chewing gum manufacture fall within the zone most conducive to human comfort. So willy-nilly, you might say, our plant is a comfortable place in which to work.

I do not wish to imply that good working conditions meant nothing in our lives. They did, and do now more than ever. I want merely to make the point that, whatever may be the starting impulse, the benefits of air conditioning are pretty much the same.

With us, air conditioning is essential. We work with hygroscopic materials like chicle, sugar, glucose, and caramel paste—materials that are instantly affected by changes in the moisture content of the atmosphere.

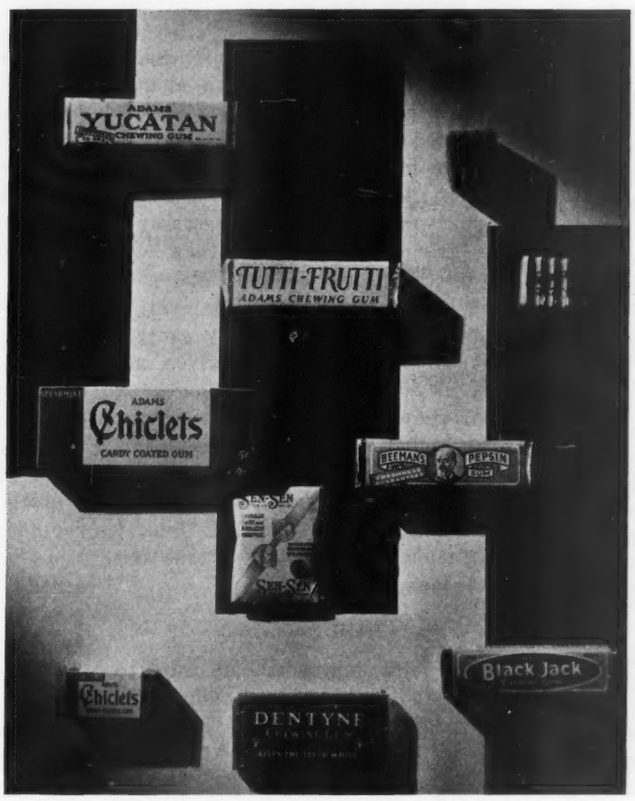
On cold, dry days the gum we make would become so hard we could not work it properly. And I am perfectly sure that if you laid down a nickel for a package of Beeman's and found it brittle, you would soon transfer your allegiance to some other brand.

Naturally we don't want that to happen.

The other condition is nearly as serious, though you would not be so apt to complain if your stick of Beeman's were a bit soft. That is what would happen to it if it were made on a warm, moist day. It would pick up at least enough moisture to complicate the manufacturing job, possibly enough to affect its quality.

Between those two extremes of a hard, brittle chewing gum and one that is too soft, is a gum that has just the right amount of moisture in it to be palatable—and just enough so that it may be worked properly.

The trick, if any, is to start out with that specified moisture content and to maintain it to the end of the process.



If you laid down a nickel for Beeman's and found it hard and brittle, you'd soon transfer your affections to another brand. So air conditioning and better gum. The trick, if any, is to start with a specific moisture content and maintain that condition to the end of the process

And From Then On

How to keep it that way while the seller waits for you to buy it is quite another story, involving first the wrapping of each stick separately, packaging five of those sticks in foil backed by waxed paper, and then enclosing the whole in the transparent, moisture-proof cellophane wrapper that has become so familiar to us all.

All the careful packaging in the world, however, will be worth noth-

ing if the right moisture content is not maintained all the way through the manufacturing process.

That is why we have conditioned air in the gum-conditioning room, in breaking, wrapping, coating, and polishing departments, and in the chicle and sen-sen drying rooms.

Not Just 10 Degrees Lower

Best operating conditions in the first four of these departments require a temperature and relative humidity that fall within the zone of human comfort. To avoid any misunderstanding, incidentally, I might add that these conditions are maintained constant throughout the year. In some plants, you know, it is considered enough merely to keep the temperature 10 degrees, say, lower than that prevailing outside on hot summer days.

In the coating department, where warmer, drier air has to be discharged directly into the pans, the temperature will range a trifle higher, but the relative humidity will be slightly lower. And, in the chicle and sen-sen drying rooms, still higher temperature and still lower humidity must prevail.

However, you know as well as I do that it isn't the heat, it's the humidity. No one could ever complain about the conditions in the departments I have just mentioned.

Equipment? A central refrigerating plant with three 150-ton steam-driven compressors. A common coil room where water is cooled as it trickles over some 8,000 feet of ammonia coils. A piping system to carry the cooled water to the points of application.

There are ten units all told for conditioning the air. Five humidify and dehumidify, serving conditioning, breaking, standard wrapping, coating, miscellaneous wrapping, and polishing departments. One of the five does double duty, serving the two departments last mentioned.

Two more units, No. 6 and No. 7, comprise merely heating coils and blowers, serve the coating pans. The first "steals" conditioned air from the miscellaneous wrapping department; the second helps itself to air from unit No. 4. Both heat the air and permit the humidity to drop to the corresponding percentage.

For the chicle and sen-sen drying rooms, there are No. 8 and No. 9 units. Each consists of heating coils and fans. No. 10, like 6 and 7, supplies air to coating pans.

Humidifying-dehumidifying units have capacities ranging from 5,000 to 20,000 cubic feet per minute. For example, the one that serves the chewing gum conditioning room—about 81,000 cubic feet of space—delivers 7,000 cubic feet a minute and changes the air five times an hour.

Cost? Around $300,000. Operating costs vary from $200 a month in the winter when no refrigeration is needed to $3,500 in the hottest summer months. Add charges for interest, depreciation, and the small amount of maintenance necessary. The grand total is more than offset by the production advantages I have hinted at—many times over, I believe, by the close quality control that conditioned air has given us. Add of course the byproduct of a plant people really like to work in.

So much has been said and written concerning these particular benefits of air conditioning that I am going to skip them. I think I have made it plain that we take full advantage of them all.

Planned Production

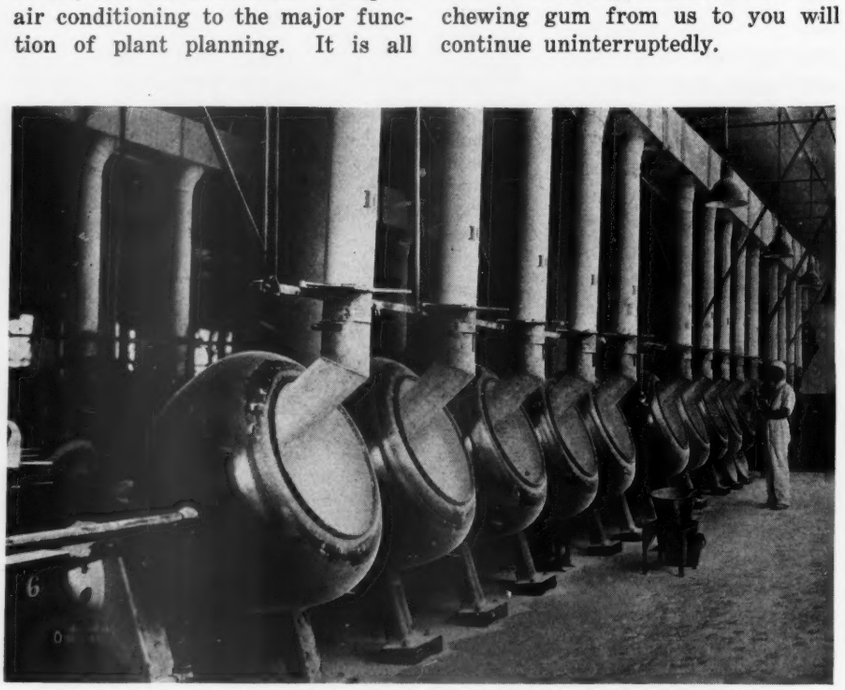
One point, however, I do want to stress, and that is the relationship of air conditioning to the major function of plant planning. It is all ancient history now, but in the before-air-conditioning era there were many days in the course of an average summer when we actually had to shut down. And there were many other days when it was next to impossible to work the product as it should have been worked.

Quality suffered inevitably. I do not mean to say that we turned out chewing gum that was not good chewing gum. But I do mean to say that we never had any way of knowing how good it was going to be. There was still quality, but by the very nature of things it could not be uniform quality. We are perfectly sure it is uniformity that counts most. When you buy gum, you want to be sure it is the same gum you bought last time.

Steady, Uniform Flow

And just as it is uniformity of product, so is it regularity of production that counts. It is undoubtedly true that workers do more work under comfortable conditions, but that phase of the production problem interests us far less than regularization. What we want to know when we plan our production schedules is whether or not we are actually going to get what we set out to get.

With air conditioning we know that the steady, uniform flow of chewing gum from us to you will continue uninterruptedly.



A battery of coating pans—all told there are 117 pans in the plant—showing the ducts that supply them with conditioned air

It's "Hour Rates" in Detroit

Some of the reasons why a group of important automobile manufacturers find it expedient to abandon piecework and bonus

FRANK J. OLIVER

Industrial Co-ordinator, University of Detroit

SINCE March of last year, and in increasing numbers since the start of production on new models in December, the principal automobile manufacturers and a few of the body plants in Detroit and vicinity have been quietly swinging back to the straight hourly wage in place of group bonus and piece rates.

The change was made in some plants progressively, department by department, in a period of declining production; in others with the beginning of new model production. Coupled with Ford's workers, who have always been on a day rate, this move places a large percentage of Greater Detroit's factory employees on an hourly rate basis.

Group bonus, group piecework, and individual piecework have been the only forms of wage incentive plans used to any extent in the automobile industry in the past decade. The group bonus and group piecework plans lent themselves readily to a standard cost system, as the bonus was usually set so that labor costs remained constant above 100 per cent efficiency. Group efficiencies seldom went below the task and generally averaged 115 per cent of task, which was liberal and did not set a killing pace. With the group piecework system, as with individual piecework, labor costs by the very nature of the set-up are standardized.

So much for the immediate history and background. This article will attempt to answer some of the questions that come to mind when some of the implications of the change are considered.

What Is This?

Is this a step forward or backward? Is it a recognition of some of the principles of better employee relationships? Is it a frank admission that the conveyor and the machine cycle time the operation and provide all the incentive necessary? Or is it part of the strategy of shadow boxing with organized labor?

Which way has plant efficiency gone, up or down? What changes have been found necessary in applying the old time studies? What changes in cost accounting?

Such a fundamental change in labor policy is profoundly significant because the employee's pay envelope is the very heart of all industrial relations. Yearly wages paid out in one of these large plants often equal the entire capital investment in plant and machinery. Must we revise our conclusion that day work is often inadequate and unfair both to employer and employee in modern mass production?

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"Is this a step forward or backward? Is it a recognition of some of the principles of better employee relationship? Is it a frank admission that the conveyor and the machine cycle time the operation and provide all the incentive necessary? Or is it part of the strategy of shadow boxing with organized labor? Which way has plant efficiency gone, up or down?"

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No, probably not! The chief reason for the change is that changing conditions make different requirements. Under *today's* conditions the straight hourly wage is considered the best thing. The old incentives are no longer operable. Next year things may be different. A weekly wage may be the order of the day. In these changing times there is no such thing as a permanent policy.

This sort of attitude implies that the change is a matter of expediency. In fact the most significant statement on this score was the remark of an executive to the effect that "of course, there are certain labor slants we don't want to talk about." He did not expand on this point, but in my opinion what he referred to was the fact that, in the undercover struggle going on in defense of the open shop, real efforts are being made to keep labor quiet.

Writing in "Automotive Industries" recently* Athel F. Denham bluntly states: "Initiated by labor and particularly the A. F. of L., the movement toward straight day-rate wages has gathered a momentum at present which bids fair to carry a major part of the industry with it. If organized labor increases its power, there is little likelihood of widespread returns to bonus systems, unless major policy changes are made by such organizations."

Then There Is 7 (a)

In the face of such a situation, and with Section 7 (a) hanging over his head, no manufacturer wants to face a group of collective bargainers over a real issue if it can be helped. The problem then becomes one of simply not letting the issues ever get hot enough for a real debate.

In General Motors's recently published policy on employee relationships, for example, the set-up is obviously designed for the settlement of all disputes within the organization, to prevent as far as possible a case from ever having to be presented to the Automobile Labor Board.

In another corporation severe penalties are placed on a foreman for failing to bring to the attention of the management any situation that might have such a kick-back. While questions of wage payment plans do not properly become subject to any constituted board's jurisdiction, they have formed one of the chief topics of debate in works council sessions. It would have been a mistake in policy to have let this one issue become the rallying point for group action on a large scale.

If part of the process of keeping labor quiet lies in abolishing piece rates and group bonus, there must have been some faults with the system. The main objective of the

*"Day Rates Supplant Group Bonus," Dec. 8, 1934.

change, as I view it, is increased satisfaction of the working force—better plant morale.

Not Able to Earn Rates

One of the biggest kicks on the part of the men under the old system was the peaks and valleys in earnings encountered in starting new models or because of fluctuations in schedules and other interruptions to production. Too frequently the men were not able to earn their rates because of material shortages and machine breakdowns—faults directly chargeable to management.

The men could not budget their expenses readily because they could not estimate their earnings closely. Furthermore, they often found it difficult to compute their earnings, even though sometimes efficiencies and rates were posted daily to aid these calculations.

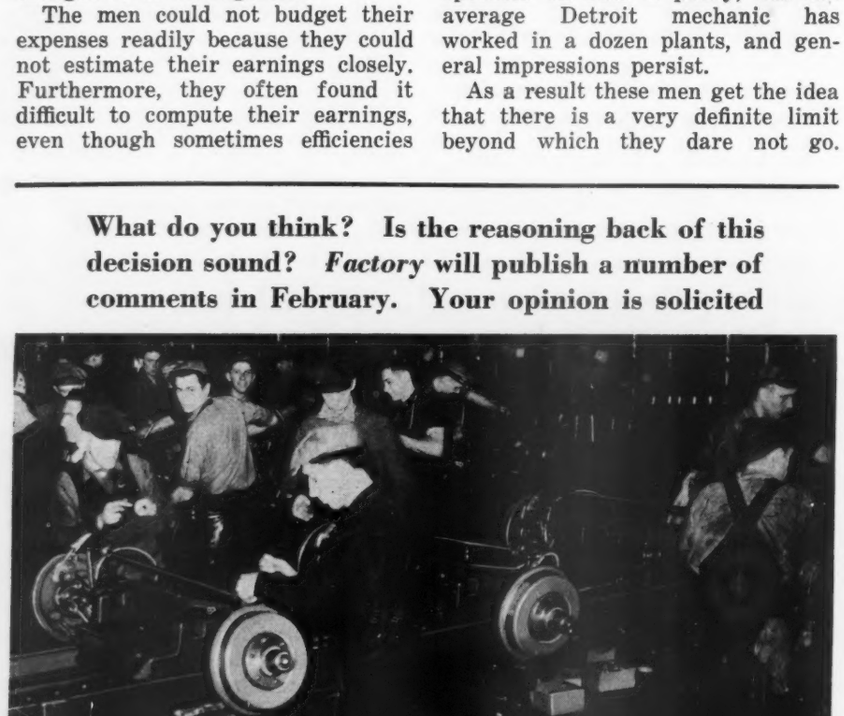
With group bonus it has always been difficult to find a completely satisfied group. The fast man feels he is being held back, as indeed he often is, and the slow one is the goat of all the others. In a 10-man group, if one man increases his output 10 per cent, he gains only 1 per cent bonus because the increased efficiency is shared by all members of the group. Such a situation tends to bring the output down to the level of the average low producer of the group, and the incentive fails.

Piece rates or group bonus are usually computed on the basis of allowing the average worker to earn a fixed amount a day, say $6.50. There is a great temptation on the part of management to find some excuse to cut the rate if the earnings of a worker or group of workers is much out of line with other earnings in the plant.

Making considerable or even slight changes in the method or introducing new tools or machinery are legitimate reasons, but the rate is generally cut so that the average worker still earns his $6.50 a day. Management does not tend to share the benefits of new methods with the workers. Not every shop operates on such a policy, but the average Detroit mechanic has worked in a dozen plants, and general impressions persist.

As a result these men get the idea that there is a very definite limit beyond which they dare not go. They are afraid to "kill" the job for themselves and their fellow workers. And the fellow who kills himself in a group is just a "sucker." There have been numerous cases of direct soldiering on the job for fear the rate will be cut. Fear of scorn or bodily injury will often hold a man back. Comparisons can become really odious under a piecework plan.

What do you think? Is the reasoning back of this decision sound? *Factory* will publish a number of comments in February. Your opinion is solicited



Traditional Opposition

Piece rates and group bonus have been traditionally opposed by organized labor on ethical grounds—namely, that such systems tend to awaken greed in workers and stimulate unrestricted competition between them. From another viewpoint, collective bargaining reduces the workers to a common level—that of the low man—and does not attempt to secure greater benefits for the more efficient workers.

Much of this labor attitude just reviewed has been expressed through works councils, A. F. of L. locals, and other forms of employee representation. In one organization, the management went a step further and asked the men directly for an expression of opinion as to which method of wage payment they preferred. There was a general preference for the flat hourly rate.

Although it appears on first analysis that all the benefits are in favor of the worker, there are also a number of advantages that management gains or retains.

In the first place, the change was made after the industry had operated on a bonus or piece rate system for many years. Most of the common operations have been motion studied in detail and definite methods of operation adopted. Rates and standards have been set as a result of painstaking time studies. A definite task or measure of what constitutes a day's work has been established. The performance of groups, individuals, or departments may be measured and compared.

Need for Other Incentives

In making the change-over to the flat hourly rate, the manufacturers have made no changes in standard times or in standard costs, under which most of them operate. It is expected that the same efficiencies will be maintained. This implies substitution of other incentives.

In effect, what has happened is that the incentive has partly been transferred to the foremen and other group leaders, and has partly reappeared in other forms. Departmental supervisors must still meet the old bogies of performance. Through foremen conferences and re-education of foremen, some corporations are trying to develop leadership methods rather than driving methods to attain these results. For one thing, the organization throughout is more alert to provide work for employees while they are in the plant because non-productive time is at management's expense, instead of at the worker's as before.

One plant official remarked that the men had "let down" as a result of the introduction of the new plan, but that the efficiency of the plant as a whole had gone up.

"The management didn't *stop* the

(Continued on advertising page 40)

How Good Is Your Management?

If a physical count of goods and materials, why not an inventory of management? Use the chart to find out how good you are

CHARLES REITELL
Stevenson, Jordan & Harrison
New York

THE IMPORTANCE of taking inventory of the management features of an enterprise has gained little attention. In fact, it has seldom been considered. At least once a year a firm will make careful count of its physical plant—its goods and materials. And the management, if it conforms to common experience, becomes concerned and often agitated with the size of the adjustment necessary to bring actual and book inventories into agreement.

The thought, however, of subjecting the management phases of the enterprise to a similar evaluation has never occurred to executives. Or, if the thought has occurred, they have done little about it.

I am certain that a competent rating of the management features will disclose even wider gaps between what actually exists and what should exist than do any discrepancies in physical inventorying.

Fortunately there is a very definite and practical approach to measuring the effectiveness of management. A careful study of managements shows that the stable profit-making ones hew closely to definite and fundamental principles. Those firms which follow these principles are found successful and prosperous, whereas those that do not, are found to be weak and floundering.

In the study which made this article possible, hundreds of firms were considered to determine the existence or non-existence of the basic principles of management. It was established that the successful firms embraced these principles and the unsuccessful ones did not.

Once it is realized that sound management is more responsible for successful industrial activity than any other factor, then the need for breaking down management into its basic principles looms important.

I am taking ten of these principles and describing them in detail. They are not all of the principles that might be enumerated but I think we will agree that they are the important ones.

1. Informed Leadership

No one doubts the importance of leadership as a means toward successful management. Without it—nothing! In present-day industry with its standardization, automatics, and fast-moving production, leadership to be effective must be kept constantly informed concerning every major division of the enterprise.

As has well been said—Leadership, to guide in the right direction, must be made acquainted with such direction. In short, fully informed leadership is essential.

Heretofore our industrial executive has rested content in measuring progress or decline by comparisons with past periods—this month with last month, present year with past year, etc.

A casual study, however, of such reporting points out both its inadequacy and quite often its fallacy. Many—in fact, most—conditions of operation change as periods come and go, thus making comparisons erroneous. What is worse, bad practices may continue to lurk from one period to another and thus perpetuate costly operations.

What is accomplished in terms of *what should have been accomplished* (i.e., standards) is a far more accurate and scientific method of reporting, and it is this type of information that the superior type of executive is demanding and is getting.

2. Sound Organization

There is little need to emphasize the importance of a sound organization. Duties and responsibilities must be clearly and sharply defined. Where there is faulty organization, there is found overlapping authority that breeds very unsatisfactory results.

Friction comes where collision of effort occurs. Losses of business and profit take place when errors of omission show themselves. A deep sense of responsibility and the fine effor it evokes are lost to management where no sharp, clean-cut understanding or authority exists.

No earnest person exists who will not respond noticeably when he or she is made definitely responsible for specific duties.

3. Balanced Financial Structure

Underlying the smooth-running and stable operation of every concern is the necessity of an adequate financial set-up.

A sufficient amount of working capital insures many profit advantages. The following are some of the advantages that are coupled with adequate financial resources:

a. Maintenance of a sound credit rating, resulting in taking at the minute every opportunity in purchasing, marketing, and necessary operating change.

b. Ability to take full advantage of all purchase discounts.

c. Opportunity of making advantageous purchases not only of materials, but also of patents and technical and executive ability.

d. Assurance that the concern can keep abreast in changing design and in mechanical improvements of equipment.

e. Ability to finance research, be it chemical, physical, engineering, or management.

f. Opportunity to expand markets and to emphasize advertising when and where needed.

g. Making of timely surveys of both management and operation to

assure that every function is maintained on a high level.

4. Proper Marketing of Product

Merchandising of product rests four square upon a full and complete knowledge of actual sales versus potential sales analyzed by territories, by product, by salesmen.

Scientific analysis of the market is essential to the establishment of sales quotas. Such an analysis with proper quotas lays the basis for coordinating sales with production.

5. Effective Physical Equipment and Layout

Management to be successful must maintain a strict stewardship over operating equipment. Four essential features must be rigidly controlled if the best operating results are to be realized.

a. Economies that may come from new equipment rest upon definite knowledge of the latest designs of available machinery and tools and

How Good Is Your Management?

THE MANAGEMENT PRINCIPLE	THE SUPERIOR FIRM	
I. INFORMED LEADERSHIP	1. Weekly or Monthly Reports from all Divisions—Production, Sales, Executive and Financial Showing (A) What Should Have Been Accomplished (Standards). (B) Variances of Actual Performance from Standards. 2. Budgetary Control Over All Expenditures. 3. Forecasts Showing Future Trends.	10
II. SOUND ORGANIZATION	1. Organization Set-Up Clean-Cut and Definite. (A) Fixed Responsibility. (B) No Overlapping Authority. (C) Complete Coordination Between All Departments, Especially Between Sales and Production. 2. Centralized Personnel Management. 3. Organization Chart Covering Both Personnel and Functions. 4. Development of Understudies for Executive Positions.	10
III. BALANCED FINANCIAL STRUCTURE	1. Adequate Liquid Investments to Meet Exigencies. 2. Funds Available for Making Advantageous Purchases and Taking Discounts. 3. Current Ratios including Inventory Controlled by Use of Budgets. 4. Financial Provisions for Replacing Depleted and Depreciated Assets. 5. Excess and Idle Capacity Carefully Measured.	10
IV. PROPER MARKETING OF PRODUCT	1. Complete Market Analysis Periodically Showing Actual vs. Potential Sales by Lines of Product, by Territories and by Salesmen. 2. Sales Efforts Analyzed, Controlled and Directed to Obtain Maximum Results from Effort Expended. 3. Sales Analyzed on Basis of Profit Realization. 4. Customer Service Made Important Function.	10
V. EFFECTIVE PHYSICAL EQUIPMENT AND LAYOUT	1. Modern Machinery Provided. 2. Layout Takes Advantage of Synchronized Progressive Line. 3. All Production On a Standard Time Basis. 4. Excellent Maintenance Provided, Keeping Equipment in Standard Condition. 5. Repairs Carefully Recorded and Standards Set.	10
VI. SIMPLE ADEQUATE RECORDS	1. All Unnecessary Records Eliminated. 2. Records and Reports Meet Specific Needs of Those Who Use Them. 3. Modern Mechanical Bookkeeping and Statistical Methods Used. 4. Records and Timely Reports Covering Products and Performance. 5. Accounting and Costs Parallel Lines of Organization. 6. Proper and Adequate Filing.	10
VII. THE DEVELOPMENT OF STANDARDS	1. Standard Costs Wherein the Accounting System Portrays Required Performance Rather Than Merely Recording History. 2. Variances from Standard Reported Daily, Weekly or Monthly. 3. Variances Subjected to Follow-Up Program. 4. Overheads Controlled by Flexible Budgets With Definite Responsibility. 5. Constant Study and Revision of Standards.	10
VIII. MEASURED INCENTIVES	1. Direct Labor Controlled by Incentives Based Upon Performance Standards. 2. Sales Incentives Provided for Sales Effort Covering Both Volume and Profit Realization. 3. Key-Man Bonus Established for all Supervisors. 4. Executive Compensation Plan for Top Executives. 5. All Bonuses Related to Super-Performance and Specific Savings.	10
IX. ADEQUATE RESEARCH	1. Constant, Planned Research Covering (A) Merchandising Methods. (B) Management in All Its Phases. (C) Production. (D) Design of Product. (E) Possibility of New Lines and New Outlets for Old Lines.	10
X. RELATION WITH YOUR INDUSTRY AS A WHOLE	1. Takes Active Part in Trade Association for the Industry. 2. Helps Establish and Maintain Fair Trade Practices. 3. Assists in Building Uniform Accounting Records for the Whole Industry. 4. Helps in Building Balanced Program—Production With Consumer Demand. 5. Complete Cooperation With Code and Code Authority.	10
SCORE	TOTAL	100

their capacity to become cost savers for given operations.

b. The best equipment, however, must be efficiently laid out to insure the most economical flow of work through the plant.

c. A fine degree of maintenance must be maintained. Faulty equipment impairs standard performance of workers and breaks down smooth routine in plant operation.

d. Timed performance is essential to reaping the best results from operating equipment. Basic studies in methods and timing form the basis of setting standards that hold equipment to a high degree of performance.

6. Simple, Adequate Records

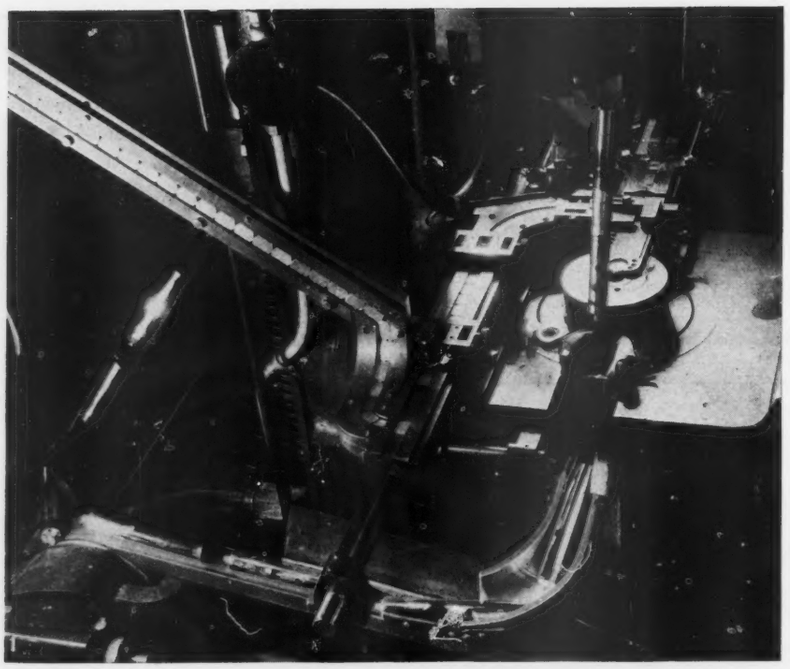
This principle provides the score of the great game of industry. Simple, usable records are necessary in measuring performance of every department and function of the enterprise.

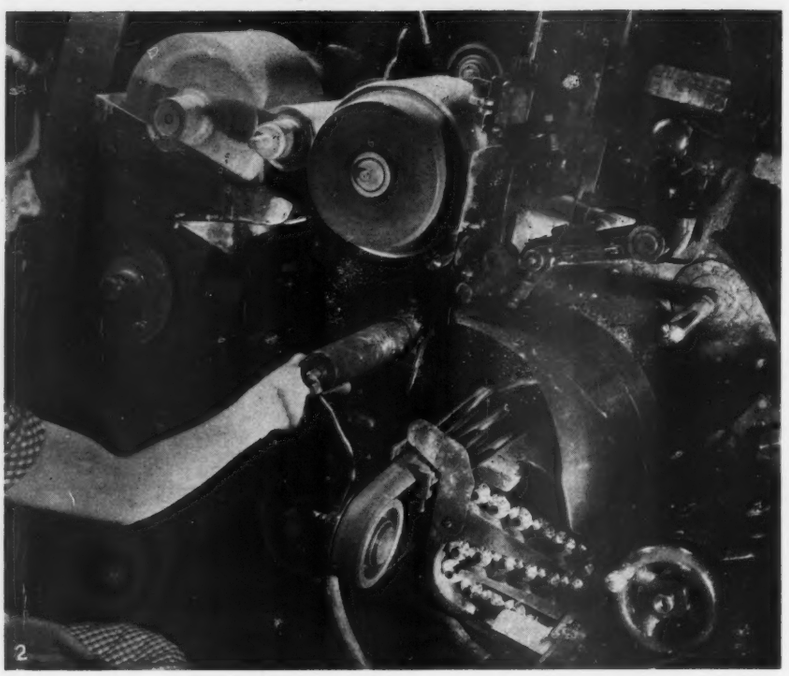
Are we doing business in the proper volume, at the proper time,

(Continued on advertising page 46)

Rate Your Own

THE AVERAGE FIRM		THE INFERIOR FIRM	
1. Reports from All Divisions Periodically. 2. Reports Give Comparisons With Past Periods. 3. No Reporting of Performance Against Standards. 4. No Scientific Budgetary Control.	5	1. Executive Uninformed—Attempt to Manage by Rule of Thumb. 2. Reports Faulty and Inadequate 3. No Thought of Standards or Budgets.	0
1. Organization Has No Serious Overlappings but Not Set Up on Best Functional Plan. 2. Coordination Between Departments Weak With Corresponding Jealousies and Conflicts. 3. No Centralized Control of Personnel. 4. Organization Set-Up Not Charted, or Chart Not Kept Up to Date. 5. Little Thought Given to Building of Under-Studies.	5	1. No Planned Organization—Grew Like Topsy. 2. Indefinite Responsibility and Overlapping of Authority. 3. No Control of Personnel. 4. Organization Chart Never Considered.	0
1. Liquid Funds Available But Not Sufficient. 2. No Measurements of the Cost of Idle or Excess Capacity. 3. Budgets Unscientific and Based on "Wished-For" Accomplishment. 4. No Financial Provisions for Replacing Assets.	5	1. Always Short on Working Capital. 2. Current Ratio Bad. 3. Purchase Discounts Not Taken. 4. No Budgets of Any Kind.	0
1. No Market Analysis. 2. Sales Analyzed on Basis of Territory, Product, and Salesmen. 3. No Analysis on Basis of Profit Realization. 4. Customer Service Not Emphasized.	5	1. No Sales Analysis. 2. No Thought or Knowledge of Market Analysis. 3. No Customer Service.	0
1. Fairly Modern Equipment But Not Best for Particular Work to be Done. 2. Layout Poor—Not Scientific. 3. Fair Degree of Maintenance—No Budget Control. 4. No Standards or Time Studies. 5. No Standards for Repairs.	5	1. Outmoded Equipment. 2. Repair Charges Heavy. 3. Little Thought Given to Proper Maintenance. 4. Scientific Layout Missing. 5. No Standards of Performance, Cleanliness or Anything Else.	0
1. Accurate Records But Unsuited for Use of Management, Therefore Seldom Used. 2. No Relations Between Accounting Code and Lines of Organization. 3. Cumbersome Methods and Too Many Records and Reports. 4. Filing Fair	5	1. Sloppy Careless Handling of Accounts and Records. 2. No Reports Worthy of the Name. 3. No Cost Accounting. 4. Filing Poor 5. No Modern Bookkeeping Methods.	0
1. Accounting System Good But Simply Writing History. 2. Only Actual Costs Obtained, Too Late for Management Value. 3. No Relation of Costs to Controlling Performance. 4. Overhead Expenses Distributed But Not Controlled.	5	1. No Knowledge of Standards.	0
1. No Sound Incentive Plan, Only Day or Piece Work Payments. 2. Sales Incentive Plan Not Related to Profit Realization. 3. No Bonus Reward for Supervisors. 4. Bonus Rewards for Executives Based Upon Profits and Not Upon Individual Performance.	5	1. No Incentives of Any Kind Anywhere.	0
1. Research Confined to Laboratory Projects. 2. Research Inadequately Financed Therefore Spasmodic and Rather Haphazard.	5	1. No Research Whatsoever in Any Field.	0
1. Membership in Trade Association Perfunctory. 2. Follows Rules of Fair Practice and Code Regulations.	5	1. Not Interested in Trade Association Effort. 2. Reluctantly Follows, if at all, the Code Requirements.	0
	TOTAL 50		TOTAL 0





They Know and Use

the best in mechanical handling, automatic machinery, air conditioning, finishing processes, housekeeping methods. Five views of an Ipana tube in the making prove that the Sun Tube Company, Hillside, N. J., overlooks few bets in economical plant operation

1. Mechanical Handling

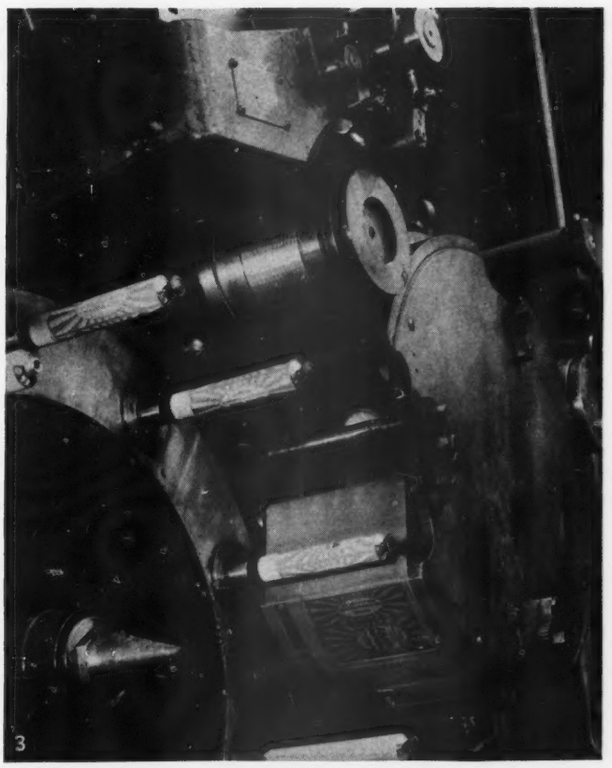
One man—aided very materially by monorail and automatic dispatching—does all the handling from blanking presses to slug storage, from storage to extrusion press hoppers. See "All by Himself," July, 1934. Extruded tubes are ejected by compressed air to the belt carrier and conveyed directly to trimming, threading, capping, and painting operations

2. Automatic Machinery

Tubes move without further handling to this machine which trims both ends, threads the necks, screws on molded caps, gives tubes a base coat of yellow paint. Painting is done by three rolls. The first picks up paint from a trough, the second transfers it from the first to the printing roll which spins the tube and applies the paint. At this point the operator transfers the tubes to an endless chain that takes them up through baking ovens on the floor above and back again to the printing machines

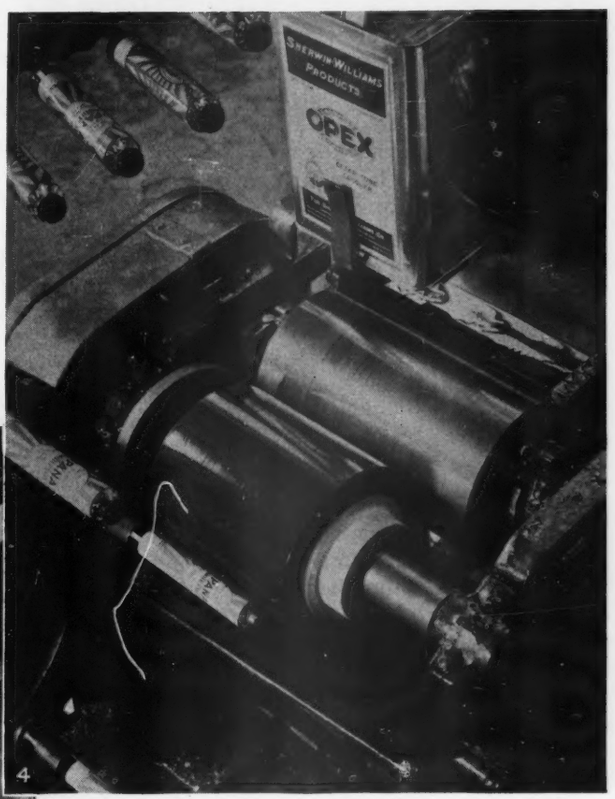
3. Air Conditioning

Quality printing—a two-color job on Ipana tubes—is assured by clean, dust-free air and close control over temperature and relative humidity. See "90 in the Shade," April, 1934. Manual handling is limited to the necessary transfer of tubes from the chain that brought them from the ovens—and, after printing, to the chain that takes them back to the ovens



4. Modern Finishing Methods

After printing, lacquering to protect the paint. Consider the treatment a toothpaste tube gets and the need for such protection is evident. After lacquering, a third trip through the ovens. On each trip close control of temperature and speed of travel. Tubes are now ready to be packed and shipped



5. Good Housekeeping

Take a look down the shipping room. Effective daylighting, supplemented by excellent artificial illumination. Paint on walls and ceiling that increases the lighting intensity. Floors, light gray. Machinery, green. When the light is too strong, wood-strip shades are drawn, cut down the glare appreciably

Photographs by Rittase, courtesy of The Sherwin-Williams Company

From 59 Steps to 22

And from 4,041 feet of travel to 285. Second of three articles on the new layout technique that is based on motion study

ALLAN H. MOGENSEN
Consulting Editor

WITH the flow process chart and the flow diagram drawn as described last month (see "Now Look at Layout," page 538), you are now ready to analyze the operation. It was pointed out that the process chart, to be of real value, must show every single step in the movement of the work.

Process charts may follow materials, men, or paper (forms) through factory or office operations. It is well not to try to combine more than one of these on a single chart, although it can be done.

Distance traveled is shown, usually in detail as in the December old-method chart and in the new method shown herewith. This calls attention to the fact that in most plants both men and materials move through unnecessarily long distances —which means higher costs, both direct and indirect labor, and more work in process than required.

Time may also be shown in a separate column on the chart, and may call attention to the fact that the work should move through all operations in several hours, let us say, whereas, due to all the waits and delays, it may actually be taking days or even weeks.

Now Ask Four Questions

After the chart has been completed, the present method is considered for possible improvement. Here the questioning attitude is essential, and unless those who discuss the chart have open minds, little will be accomplished.

Four questions should be asked of *each* symbol on the chart:

1. Can the operation be eliminated?

As Dr. Lillian Gilbreth has said, "Entirely too many operations are studied that should never be done at all." This, therefore, is not an easy question to ask, especially if your group has been connected with the operation for a long time. But do not leave the symbol until you are sure that it cannot be eliminated entirely.

It is the ability to ask "WHY?" that is often responsible for the unusual success of the outside consultant. Coming into a plant for the first time, he naturally asks *why* and in all too many instances the answer is, "Well, we have always done it this way." With the flow process chart in front of you, you can get the outside viewpoint on an operation, no matter how close you are to it.

Once So Far, Now So Near

Taking the flow chart on the spring shown in my December article, the first symbol was a permanent storage in raw material stores. *"Why?"* seemed foolish to those present for the discussion, but it soon developed that the material could all be stored right on the spring job, thus saving 1,100 feet of travel on the part of the operator, who went all the way down to the storeroom, took out the coil of wire, weighed it, took it up to the spring job, ran off the required number of springs, and then took the remainder of the coil back for credit.

Compare the steps (*1* through *10*) in the old-method chart (December) with the new chart. The stores department still exercises control over the material, but it is delivered right to the spring job, and kept in racks only a few feet away.

Likewise many other symbols when questioned were eliminated, as can be seen by comparing the two charts. If it was found impossible to eliminate the operation, the next question asked was:

2. Can it be combined with some other operation?

This question was asked on symbols, *2, 3, 4, 5, 6,* and *7* on the old chart. Why wind on one machine and then cut off by hand, and then grind the ends? It developed that a new spring-winding machine was available that would wind, cut off, and flatten the ends all in one operation. A survey indicated that by

PROCESS FLOW CHART
Coil Spring
New Method

	Operation	Distance
△	Ahead of operation	
M	To spring winder	10
1	Wind, cut off and flatten ends (New spring winding mach.)	
M	To outgoing platform	15
▽	Waiting for electric truck	
2	Load on truck	
K	To hardening room	40
3	Place in wire basket	
M	To niter tank	10
4	Heat	
5	Quench	
6	Dip in oil	
7	Empty into pan	
M	To inspection	30
8	Test for hardness, diam. & lead	
M	To setting equipment	10
9	Place in setting fixture	
▽	Set	
10	Remove from setting fixture	
M	To outgoing platform	10
▽	Waiting for electric truck	
11	Load on truck	
K	To part stores	160
12	Unload	
▽	Part stores	

SUMMARY

Number of operations	12
Number of movements by man	6
Number of movements by elevator	0
Number of movements by electric truck	2
Number of waits for trucking	2
	22
Total distance traveled	285
Saving in distance traveled	3756

If one picture is worth 10,000 words, two ought to be worth—but look at the new process chart on the coil spring, also the flow diagram across the page. Compare them with the chart and the diagram shown on pages 538 and 539 of last month's issue. Then see what motion study has done to plant layout

making the layout changes, together with the economies, the new machine would pay for itself in less than a year. So it was purchased. *Operation 1* on the new chart indicates the new method.

After this question has been asked at every step, and if no further combinations are possible, the next question is:

3. Can we combine the sequence of operations?

Referring again to the old-method chart, the springs were inspected at *13* and again at *23*. By moving the whole operation into one room with the exception of heat treating, it was a simple matter to hold the first inspection over until after the heat treating. Before, under divided responsibility, each department insisted on inspecting its work.

And Finally

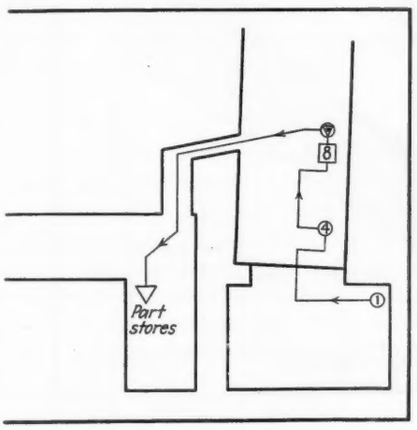
If no further changes in sequence can be made, then, and *only then*, do we ask the last question:

4. Can it be simplified?

Too much motion-study work fails because it starts at this point. Elaborate set-ups are made when perhaps a new layout is much more important—when, in many instances, the operation need not be done at all.

In our spring operation, after the layout was finally approved, and all points carefully checked, the setting operation, following number *26* on the old chart, was studied for improvement. Instead of stringing up on rods, a slow and dangerous operation, a new fixture was designed that enabled handling many more springs at a time, and in a fraction of the former time.

The flow diagram shows the change made in the layout. The new spring room was set up at the nearest possible point to the heat-treating department, as it was not economically feasible to justify special equipment for this operation.



Thus the work originates in the spring room, goes into heat treating, into the inspection room right in the department, is placed immediately in the setting fixture, and then trucked to part stores. The distance traveled is thus only 285 feet, a saving of 3,756 feet over the previous method. Operations were reduced from 59 to 22. All elevator moves were eliminated. Process time was cut from days to hours.

Naturally this one job did not revolutionize costs in this particular plant, but it was the beginning of a survey conducted in the same manner on all major items that has resulted in a complete new plant layout, with very attractive savings.

In going through your present-method flow process chart, do not neglect the opportunity to solicit suggestions from those working directly on the operations. It is often assumed that workmen and foremen are incapable of such suggestions, whereas some of the most valuable have come from this source.

One man, sitting down to go through the procedure, will not make much headway. However, a group will soon have worth-while ideas coming faster than they can be set down.

The use of the process chart reverses the unusual procedure in a layout study. Instead of making a change in any subdivision of a process, merely because that subdivision may be the easiest to change, or may appear to be the one offering the greatest opportunity for improvement, it permits consideration of all those preceding and following the subdivision. Unless they are all considered, the change may be found unsuited to the ultimate plan of operation.

After the present method has been pulled apart, analyzed, and synthesized, the new process chart is drawn up, and the new layout diagram drawn. Cost estimates of proposed changes must be made up to make sure that the new method will be justified.

Next month's article will show how to make the new layout, discuss the use of templets, further use of flow process charts, how to make the cost checks, how to sell the layout. The latter is most important—many a good layout has fallen down because it was not sold right to management.

Henry Laurence Gantt

MENTION Gantt to the younger man in industry—or for that matter to many an older man—and his reaction will very likely be oh, yes, the man who made the chart.

Right. Gantt invented the Gantt chart with its thousand and one applications. But he did so much more that the editors depart from their custom of merely listing current books on management and make special announcement of a Gantt biography* that was published last month.

The biographer is L. P. Alford. Alford knew Gantt. He knows a lot of other people who knew Gantt. Because of their help and his own long identification with the management movement, he is peculiarly fitted to appraise Gantt's work.

The fact that the biography was written under A.S.M.E. auspices is further guarantee of its worth.

Why read it? Because it presents a background for the work you as a plant operating man may be doing today. Because the Gantt chart is perhaps the most important tool of management ever given to industry. Because Gantt's task-and-bonus plan was the forerunner of all the many methods of wage payment that use an interval of time as the unit for setting standards and comparing results.

Of these contributions and many more to the science of management, Mr. Alford has written both sympathetically and entertainingly.

*Henry Laurence Gantt, by L. P. Alford. Harper & Brothers, New York. $4.50.

An Approach to Profit

Better sales! Greater profits!
First of three articles on profit
from scientific sales planning

C. E. KNOEPPEL*
The Knoeppel Company, Philadelphia

THE BUSINESS and financial worlds have come to place considerable reliance in the conventional financial statement in judging the progress of a given business and the worth of its management. Such a statement is made up of:

1. Balance sheet which portrays the capital set-up of a business.

2. Profit and loss statement as the final summary and record of the operating results.

With no desire to detract from the value of the work of accountants and auditors in the preparation of these essential records so necessary in appraising business results, it is nevertheless my firm conviction that these documents expressed only in figures are merely *static* portrayals of results at and for the time they are made, and do *not* show *where* a firm is trending, *what* the results are likely to be under variable conditions, and the reasons *why*—an advance knowledge of which would facilitate a quicker use of remedial measures.

Barometer vs. Thermometer

The conventional financial statement is merely the *business thermometer,* telling what the economic condition is at the moment.

Because each business is a *moving* entity, a still picture of results no longer serves the purpose of the executive who wants to see his business in perspective as it moves toward or away from the required results.

What is necessary, therefore, is some mechanism analogous to the moving picture machine which will project on his mental screen the *probable* results of his business under *variable* conditions. If he is to pilot his business ship effectively, he must have something that will present the fundamental inter-relationships of his capital, costs, sales and profit and loss, on a *moving* basis, so as to show him at what stage of the changing course of business his concern is at any given time.

This calls for the business *barometer,* which measures economic pressure and predicts profit change.

In my early professional efforts to give a Pennsylvania client this kind of device or "management tool" (1908-1909), I was led to prepare a form of charting based on a most fundamental principle, stated on page 376 of my book, "Graphic Production Control" (The Engineering Magazine Company, 1920), as follows:

Figure 140 illustrates the manner of showing graphically a business as a whole, so as to be able to tell where losses end and profits begin. There are naturally some costs which must be met, whether there is any work done or not. In other words, cost does not begin at zero, but at a point which represents fixed expenses, whether the plant operates or not. When goods are being produced, costs are plotted from this point. By plotting sales from zero, the costs and sales lines will cross at some point, to the left of which there will be losses, and to the right, profits. By plotting actual figures and capacity against these lines some valuable information can be secured.

The Profitgraph

The charting in question was the forerunner of the chart now so well known in industry as the Knoeppel Profitgraph, which in reality is a "graphic variable profit and loss statement," or *business barometer.* The application of the Profitgraph

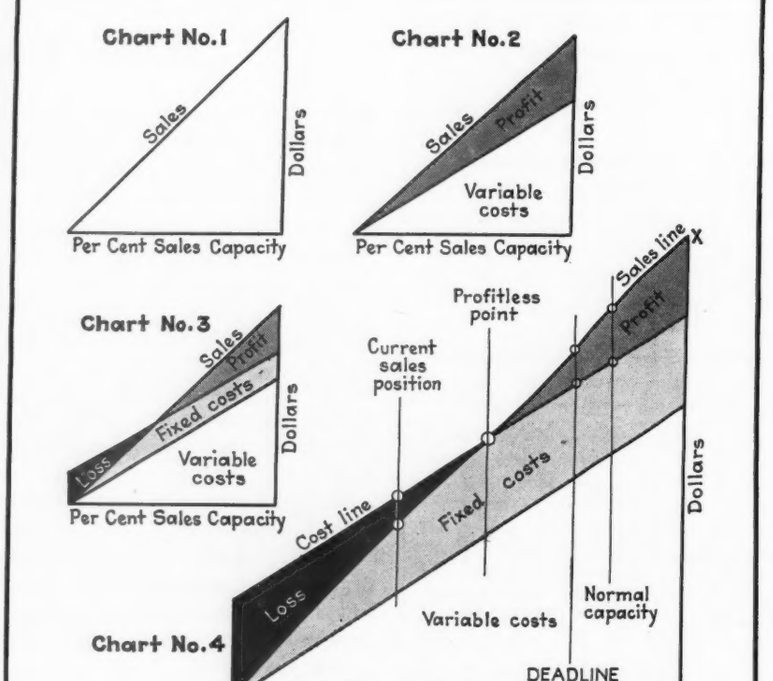
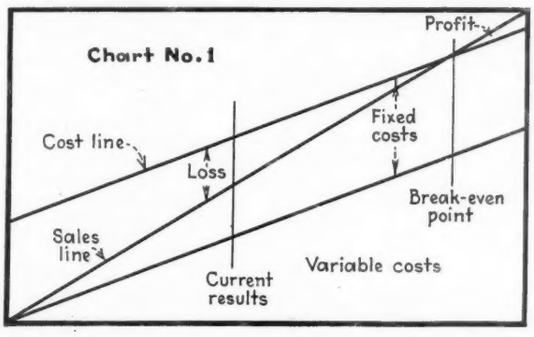
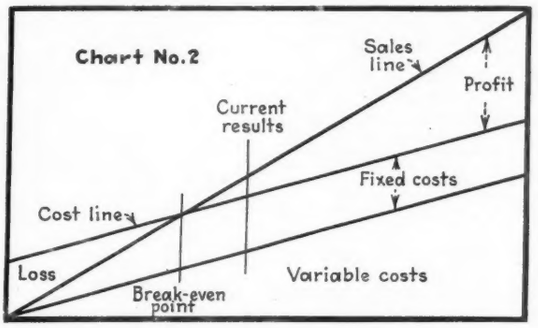


Figure 1

*With Edgar G. Seybold collaborating.



Low potential due to high variable and fixed cost. This concern could not make a profit until it reached the point where the sales line crossed the cost line. Assuming the chart to record total plant capacity and the "current results" line to indicate actual sales, it would be too much to expect a profit with these costs



High potential. Note here that the "break-even" point, where the sales line crosses the cost line, means that the company has an opportunity to make a profit because of its low fixed and variable costs. This is a simplified illustration of the ability of the Profitgraph to show beforehand the chances for a profit

Figure 2

to profit control may be found in a series of six articles that began in the Jan., 1930, issue of *Factory and Industrial Management.*

A further description of the evolution and technique of the Profitgraph appeared in the Dec., 1931, number of the same publication. The Profitgraph itself was published in April, 1930.

To give credit to the original source of the idea, let it be said that the inspiration came from reading a series of articles by Henry Hess (of Philadelphia ball-bearing fame), in the April, May, and June, 1904, issues of "The Engineering Magazine" (later "Industrial Management," now a part of *Factory Management and Maintenance.* Hess was describing the wage-payment plans of that day and used several "cross-over" charts to show the effect of these plans on profit and loss.

Fundamental Inter-Relationships

The principle of the charting itself is very simple.

A business can be represented by a right-angle triangle (See Figure 1, Chart No. 1). If all costs in a business were variable costs, then our triangle would look like Chart No. 2. But because we have fixed costs as well as variable, our triangle now looks like Chart No. 3.

When we calculate the rate at which sales are actually going, and determine upon the normal capacity as well as the *deadline* (where profit in sales equals 5 per cent on the net worth as interest on investment), then the triangle looks like Chart No. 4.

Thus we get a real picture of inter-relationships on a *moving* basis, showing the executive not only where he stands, but what he must do to reach his desired goal.

Because fixed and variable costs are so vital a factor in portraying fundamental inter-relationships in various combinations, it might be well to explain what we mean by the terms.

Variable costs are costs or parts of costs which rise or fall with rise or fall in sales volume.

Fixed costs, however, are of three kinds:

1. "Shut-down" fixed costs, like taxes and insurance.

2. "Nucleus" fixed costs, made up of those necessary to maintain a minimum organization on a "going" or *in business* state, like part of salaries of executives, part of supervisional and clerical expense, part of office cost, part of advertising and selling, part of power costs, and part of other like items.

3. Managerial fixed costs, made up of items variable in character, which, due to lack of flexible cost control or reasons of policy, become fixed in the lower capacity ranges.

Every concern, regardless of its product or extent of its market, has its own fundamental characteristics at the rate it is going, *which govern its likelihood of making a profit.*

This is designated as its *profit potential.*

Possible profits are dependent on the proper alignment or inter-relationship of three basic factors—total of costs that vary with sales, amount of fixed costs, and movement in sales volume. These factors when charted determine beforehand whether there is a possibility of producing profits under existing conditions, a fact which cannot be told from an analysis of profit and loss statements alone.

Two simple charts, Figure 2, illustrate the two extremes of profit potential.

Governing this profit potential is the *variability rating,* found by dividing variable costs by sales income.

Effect a Compound One

As important as is this variable cost content in its influence on the "profit potential," we must not overlook the height of the fixed cost area, as it will be seen from the charts that *it is this area which causes the "cross-over" of sales and costs lines.* The greater the height, with given variable costs the same, the higher this "cross-over" point.

In other words, the effect can be and often is a compound one, as cost combinations can be made up of (1) high fixed and low variable, (2) low fixed and high variable, (3) low fixed and low variable, (4) high fixed and high variable, with gradations in between.

So long as accounting depends entirely on an arithmetical process, the resulting profit and loss statements in static figures cannot reveal the inter-relationships of sales income, fixed and variable costs, various sales capacity percentages, and profit and loss, on a *moving* basis.

As will be seen from the charts, *we are dealing entirely with triangles,* and thus we enter the realm of higher mathematics if we

Table I. Mathematics of the Profitgraph

THE PROFITGRAPH is really made up of two triangles. See Figure 3. Obviously, if variable costs divided by sales income gives us the per cent of variable costs or $\left(\frac{V}{S}\right)$, then the difference between sales as 100 per cent and the per cent of variable costs equals the per cent of fixed costs plus profits (or minus loss), or $\left(1-\frac{V}{S}\right)$.

To determine the "profitless point" sales and their per cent of capacity, this is the mathematical formula:

$$\frac{\left(\frac{F}{1-\frac{V}{S}}\right) = \text{Sales in dollars}}{\text{Sales in dollars @ 100\% capacity}} = \text{Per cent of sales capacity}$$

To determine the sales and per cent of capacity to take care of fixed costs and X dollars of profit, this formula would be necessary:

$$\frac{\left(\frac{F+P}{1-\frac{V}{S}}\right) = \text{Sales in dollars}}{\text{Sales in dollars @ 100\% capacity}} = \text{Per cent of sales capacity}$$

To determine sales and per cent of capacity to earn dividends, the formula would be:

$$\frac{\left[\frac{F+\frac{\text{Required dividends}}{1-\text{Income Tax Rate}}}{1-\frac{V}{S}}\right] = \text{Sales in dollars}}{\text{Sales in dollars at 100\% of sales capacity}} = \frac{\text{Per cent of sales}}{\text{capacity}}$$

From this brief description of the mathematics of the Profitgraph, it can be seen that many other formulas could be developed. For instance, the formula

$$\left(\frac{F}{F+P^*}\right) \times \frac{\text{Per cent of sales capacity at profit point}}{}$$

which gives us the per cent of "profitless point," also furnishes the basis for the reverse formula to determine *allowable fixed costs*, as follows:

$$\frac{\text{Profit}^* \times \text{Profitless point desired}}{\text{Per cent of sales capacity at profit point}} - \text{Profitless point desired}$$

***At some point of sales capacity.**

are accurately to determine these inter-relationships. See Table 1 for the mathematics of the Profitgraph.

The Williams Technique

In his epoch-making paper, "A Technique for the Chief Executive," before the Taylor Society, December 3, 1921 (published in the April, 1922, Bulletin of the Society) John H. Williams presented a complete plan for budgeting the affairs of a business and stressed many fundamental elements which are part of the practice of today.

Here is the substance of the Williams mathematical technique described in this paper in the simplest possible form:

Items	*Sales*	*Costs*
Higher or maximum reading	$150,000	$125,000
Lower or minimum reading	100,000	90,000
Difference	50,000	35,000

$$\frac{\$35{,}000 \text{ cost difference}}{\$50{,}000 \text{ sales difference}} = 70\% \text{ as "variability"}$$

$150,000 sales × 70% as V = $105,000 as variable costs

$125,000 cost — $105,000 variable costs = $20,000 as *fixed costs*

$100,000 sales × 70% as V = $70,000 as variable costs

$ 90,000 cost — $70,000 variable costs = $20,000 as *fixed costs*

This is known as the "degree of variability" formula, using two points of sales and corresponding costs, on a budgeted basis.

The mathematics behind the calculation just made for finding the per cent of variable costs, when two budgeted sales points and two corresponding budgeted costs are known, is that which covers the

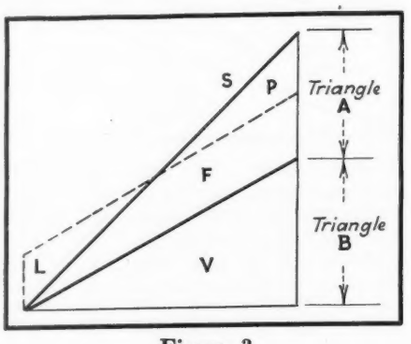


Figure 3

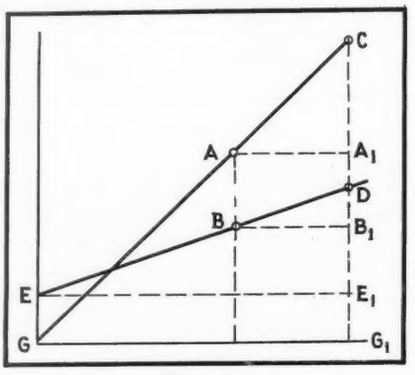


Figure 4

"relationship of sides of triangles." See Figure 4.

A and C are the two sales points; B and D are the two cost points.

Difference in sales is the line A_1C

Difference in costs is the line B_1D

Per cent of "variability" is the line E_1D divided by the line G_1C or $\frac{E_1D}{G_1C}$

To prove that:

$$\frac{\text{The difference in costs } (B_1D)}{\text{The difference in sales } (A_1C)} = \%\text{ variability } \frac{E_1D}{G_1C}$$

(1) $\frac{A_1C}{AA_1} = \frac{G_1C}{GG_1}$, since the sides of two right-angled triangles, having equal angles, are proportional

or (2) $\frac{A_1C}{AA_1} = \frac{G_1C}{EE_1}$, by substituting EE_1 for GG_1 in equation (1)

(Continued on advertising page 44)

When You Don't Hire Me

Slip me the bad news gently but firmly. No stalling. No fibbing. Make me a booster, not a knocker

CHARLES S. STEVENSON
Kansas City, Mo.

. . . . not all the snooty employment managers are working for the government

WHEN you *hire* me, naturally I think you're a great guy! A regular fellow! But when you *don't* —well, if *I* were doing the employing, I'd like to be a great guy and regular fellow to those I *don't* hire.

I don't mind filling out application blanks; I'll stand up indefinitely to see you; I'll be patient while you talk to a lot of people before you talk to me (salesmen, I like to think they are); but when you do finally get to me, what hurts is the casual, indifferent, tolerant manner with which you consider my application and the breezy, yet patronizing and heartless way you turn me down.

Two Hundred Boosters

Why wouldn't it be darn good advertising for a firm to have a human, sympathetic sort of employment manager? If he has only twenty applicants daily, five days a week—that's a hundred people. They've all relatives at home waiting to hear from him. Suppose each has only two. That's two hundred chances to get boosters! Why not get them?

There's an employment manager in a midwestern city who considers an average of thirty applicants daily —on the top floor of the plant. He has given his elevator operator positive instructions to report to him any remarks made by disappointed applicants following interviews with him. He was astounded at the unfavorable comments she reported.

"I must have been extremely patronizing, something I really despise," he confessed, in talking of his experiences later. "Here are a few of the remarks.

" 'Why, that dirty bum, he never even looked at me and barely glanced at my application.'

" 'Oh boy, I'd like to take a swing on that guy. What does he think we are?'

" 'Why do they let men like that do the hiring?'

"When I discovered that several girls had gone away crying, I did a right-about face in talking to folks looking for work."

Commissioner George E. Allen, one of three such for the District of Columbia, after a week's junket on his own expense investigating the efficiency of government relief agencies, had this to say:

"Our employment system is wrong from beginning to end. The snootiest people on God's green earth are to be found around the employment agencies run by the Federal Government."

Maybe so, Commissioner, but not all the snooty employment managers are working for the Government!

If I were employment manager for a big or little company, I'd look applicants straight in the eye, use a pleasant, sincere tone, and with unhurried, patient words I'd try to make them feel that at least one person in this great country of ours considered them as human beings.

Don't tell me now they won't let you—that they are insolent, rude, sullen. They've taken a lot of tough knocks. Please excuse. Try, anyhow, to be considerate and gracious so they can see a real guy before them—one who, even if he can't give them a job, has got some of the brotherly love stuff you read about.

Whole Truth and Nothing But

And another thing—no evasions, no stalling, no fibbing, none of this "Well, I'll see what I can do," or "Sure, we'll keep your card on file," or "If anything turns up, we'll let you know." If the fellows who have told me this were laid end to end—well, I wish they were. We should rather hear a definitely negative answer than to be kidded along. If you make us think there might be a chance, we are just as likely as not to take the line of least resistance and quit looking for another job right there. Of course we shouldn't be that way, so help us by telling us the whole truth and nothing but.

The author of this series of six brief articles has, with various firms, been stock boy, shipping clerk, purchase clerk, assistant auditor, maintenance man, employment manager, operating assistant, and is now general manager. He has often represented management, but remains in heart and position an employee. His comments, therefore, represent a point of view frequently expressed to other employees, very rarely to management

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Slip us the bad news gently but firmly. Tell us we haven't a chance and we'll probably let you alone. If you story to us, we pay you a return visit—we remember you, but you don't remember us—you turn us down—we term you a big so-and-so —your firm is a no-good this-and-that—and nobody is any place!

Next month—
When You Hire Me

Pensions—When, As, and If

Indications are that the new Congress will propose legislation for old-age pensions. Let's review the fundamentals so we'll understand the bills

G. CHAUNCEY PARSONS
Insurance Consultant, New York

A SOUND pension plan must be calculated on actuarial principles, not just guessed at. The elements of actuarial calculations are mortality and compound interest, to which must be added the cost of operating the pension business.

Actuaries have developed tables showing the average number of years which each group can be expected to live. For instance, at age 65 the expectation of male lives is 13.44 years; females, 15.76 years.

Compound interest is easy to figure if we know the rate. To illustrate, if we have a man now 30 years old who is to be retired at age 65 on, say, a pension of $100 per month, we know that when he is retired we must have a fund sufficient to pay the $100 per month for his average expectation. The law of averages works whether one individual lives longer than average or dies sooner, provided we have a group of at least 10,000 people.

To accumulate the fund over the 35-year period (age 30 to age 65), we make annual or monthly deposits, to which is added compound interest. If we know in advance the interest rate, we can figure the annual deposit. If we do not, we can make no accurate calculation.

This is the soundest and cheapest method of setting up pension funds.

Funded vs. Unfunded Plans

Funded—Under a plan set up with properly calculated reserves, the pension is purchased while the worker is an active producer on the payroll, and the pension cost becomes a charge against current, not against future, profits.

The accounting is substantially the same as that for depreciation. Each contribution buys a definite amount of pension which in itself is really a complete transaction.

Moreover, in case of merger or insolvency, it would have no effect in any way on that part of the pension already bought and paid for. Workers are therefore fully protected. With pension costs guaranteed for a certain period by a responsible organization, business can figure its costs in advance.

The funded plan is the only sound basis for pension calculation.

Unfunded—No reserve is set up to meet the liability of the future pension to workers. Costs are just added to the payroll long after the worker is retired.

This is the most expensive way of financing pensions.

Worker Should Share Cost

Contributions — A sound plan should be contributory. The worker should share in the cost of providing his own pension. Only in this way do we have the worker really interested and at the same time keep down the costs to industry.

Costs—On a 50/50 contributory plan costs will vary dependent on the average of age groups and amount of pension, and will run from 3 to 6 per cent of payroll.

If credit is given for past service (employment service commencing prior to the installation of the pension plan), the necessary additional premiums must be made up. This premium can often be amortized over a number of years.

Retirement Age—Varies with sex and industry. It is usually fixed at 65 for males and 60 for females. In some industries special conditions make earlier retirement decidedly advantageous.

Guarantees — The pension fund should be absolutely separate from those funds of the company for which the plan is set up. It should be subject neither to attachment nor to withdrawal due to merger, insolvency, or any other reason. Trusteeing is the only answer.

A pension fund is set up for one purpose only—the paying of pensions to retired workers.

Should the worker die, his part of the fund with interest added should be returned to his beneficiary.

Should he leave either voluntarily or involuntarily after, say, 5 years or at the most 10 years, that part of his pension purchased by his employer should also be his, available to him, however, only as a paid-up annuity at normal retirement age.

Protective Provisions — Each worker should be furnished with a certificate, describing the plan in simple language. The employee should have the option either before or at retirement of selecting various forms of annuities, subject to certain contract restrictions. No one can foretell what his condition or financial responsibility will be or what dependents he may have at the time of his retirement. It would, therefore, be unfair to limit him to one form of annuity.

When Employee Is Laid Off

There should be a probationary period applicable to all employees. The length of this period varies, among different industries, from six months to two years. It should be provided in the plan that, in case of lay-off, the pension plan be either continued for a reasonable time or held in abeyance until such time as the employee returns to work.

So much for the requirements of a sound plan for old age pensions. They are set down here so that you will have enough information to appraise the various plans you will hear about when the Congress begins to consider pension legislation. Here are a half-dozen types that might be proposed.

Plan I

The Plan—A general Federal industrial pension law covering all industry regardless of geographic loca-

tion, type of business, or number of employees. This plan would be administered from Washington, the costs to be met by a tax on all payrolls, and all pension funds to be invested and controlled by this board. All payments would be made from the administration office direct to the pensioned worker.

Whether contributions would be collected from the workers (as proposed under the Railroad Pension Act) is an unknown factor.

Obviously, actuaries would have to calculate the correct charges against payrolls.

Comments — Would the Government be willing or in a position to guarantee a pension rate or cost for a certain number of years so that industry could calculate its costs?

Could interest rates be guaranteed? Without a guarantee of interest rates, it is impossible to calculate pension costs. The past history of the fluctuating interest return on government securities would hardly seem to guarantee what costs are going to be. The power of taxation, of course, would be resorted to in emergency.

Mortality can be calculated, but annuities (which is what pensions really are) are composed of two major factors—mortality and compound interest—to which must be added the cost of doing business.

Would there not be created just another bureau, many departments, and a great many divisions to handle the tremendous amount of work that a national plan would impose?

There is the added possibility that government employees necessary to handle this business would not be properly trained for their work but simply political appointees—faithful party workers.

With regard to state and municipal plans now in effect, to the best of the writer's belief and knowledge they are unfunded, hence fundamentally unsound.

Plan II

The Plan—A general Federal pension law putting a tax on all industrial payrolls and collecting it through an administrative office in Washington—with the proviso, however, of agreeing to refund to each of the several states any and all contributions received from sources within that state provided the state sets up a plan at least equal to or exceeding the requirements of the Federal plan. If no state plan was in operation, then the Federal plan would function.

Comments — This plan would really result in 49 varieties if all our states and territories passed legislation meeting the minimum requirements of the Federal law.

Again we would have 49 state bureaus and administrative offices in addition to the Federal ones.

There would be an added difficulty in the transfer of employees from one state to another. Just how this could be worked out satisfactorily all around, particularly to the employees, is not clear.

Many companies and industries have various interstate activities, and because of them the present burden of income and corporation taxes is top-heavy. Many of these companies have from 49 to 200 different income tax reports to make. Thus, if they are going to have a different pension retirement plan in each state in which they do business, it is going to be an added source of trouble, complaint, and irritation with nothing of a practical nature accomplished.

Plan III

The Plan — Federal legislation making an industrial pension plan mandatory for each general industry and setting up general low minimum requirements which would have to be met or exceeded by industry—leaving, however, to each industry the opportunity of working out a plan that would meet its particular problems.

This could be done by trade associations or other organizations created for the purpose. Contributions covering pension requirements would be paid either to the necessary administration at Washington or perhaps to an administrative office set up by the trade associations under governmental supervision and certification of compliance.

Comments — This plan would be fairer to industry as it would leave some latitude in development. However, the same cost factors and the same bureaucracy would apply as in Plan I.

Another fact involved is the transfer of labor, either voluntarily or involuntarily, from one industry to another. What to do with earned pension credits?

(Continued on advertising page 52)

"Oh, Doctor!"

Unemployment Compensation

Correction of possible misunderstandings, progress report on enactment of legislation, details of Deane Plan, prospects for 1935

IN LINE with *Factory's* editorial policy of supplying a complete picture of current proposals for social legislation, the following information is presented to supplement the description of the Wisconsin plan (October, 1934, page 446) and the discussion of unemployment insurance that began on page 525 of last month's issue. It will serve to clear up one or two points that may have led to misunderstanding. It presents a concise summary of progress to date in the enactment of legislation. It describes the Deane Plan, a proposal that has been little publicized, but much discussed by the socially minded. And it hazards a guess at what the Administration, lacking definite proposals from industry, is likely to hand out.

Recent articles have followed current practice in applying the term "insurance" to any plan designed to compensate workers for involuntary unemployment. Distinction has been made, however, between so-called "insurance" and "reserves." If the funds are administered by industry itself, they are usually called *unemployment reserves;* if pooled in a state-wide fund, the method is commonly called *unemployment insurance.* Reserves contemplate payment only until the funds are exhausted, insurance contemplates payment throughout unemployment.

What Insurance Is

Strictly speaking, insurance is a distribution of risk and a sharing of losses through pooled funds. Contributions to insurance funds are based on actuarial computations—possible only when there is adequate information about the risks. The risks of unemployment, however, cannot be measured, and the only remnant of insurance in most legislative proposals for unemployment relief is in the pooling of funds.

A better term for any plan that contemplates job security is the well-understood expression, *"unemployment compensation."* Compensation is the primary purpose of every current proposal. The term appears in the title of the Wisconsin Unemployment Compensation Act, the first and only law enacted in this country. And it is familiar to workers through its uses in the workmen's compensation laws.

Another point often misunderstood. No proposal for unemployment compensation offers full protection against all unemployment, as the word "insurance" implies. Every plan that deserves serious consideration sets definite limits upon amount of compensation and number of payments.

One more question comes up. Some authorities hold that stabilization activities following the adoption of nation-wide unemployment compensation laws will have the immediate effect of reducing the number of regular workers employed in many plants. If it does, it will be a new form of technological unemployment which need have no serious consequences if industry continues to develop new products and processes as rapidly as it has in the past. But it will be a problem that industry alone cannot solve. Governmental aid will perhaps be required—at least a nation-wide system of employment exchanges—possibly relief for unemployed workers until they get new jobs and aid in transferring them to new locations or training them for new jobs.

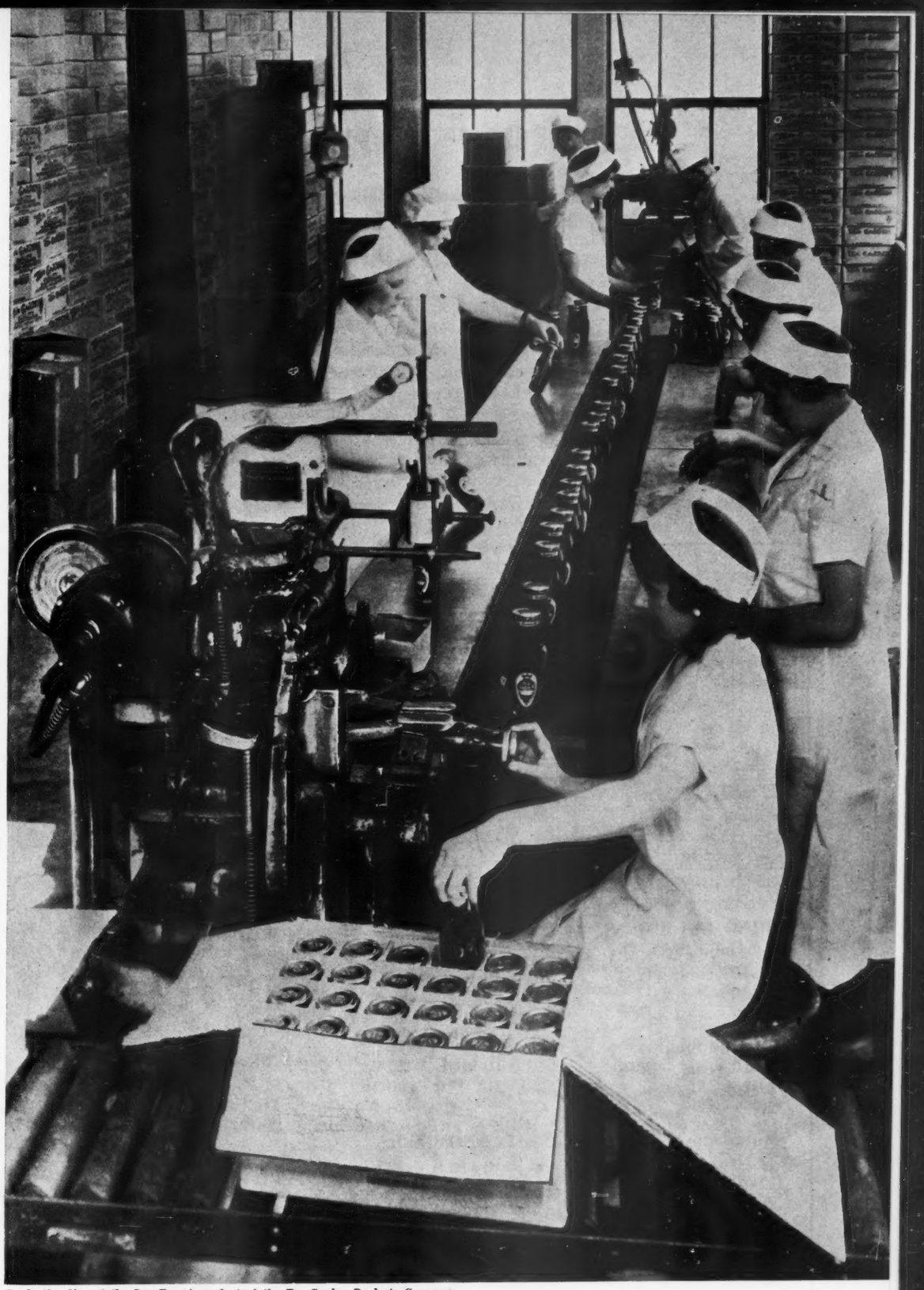
To Date—One Law

To bring *Factory's* treatment of the subject up to date, what progress has been made in the enactment of unemployment compensation laws? First, the Wisconsin Law. Enacted in 1932 and taking effect July 1,

(Continued on advertising page 56)

Table I. Essentials of Unemployment Compensation Laws and Proposals

	Wisconsin Act	"American Plan"	Ohio Plan	Massachusetts Plan
1-Minimum Number of Employees Covered	10	4	3	10
2-Eligibility Requirements				
Work in State	....	13 weeks	26 weeks	....
Service with Employer	2 weeks	....	....	8 weeks
Maximum Income	$1,500	$2,000	....	$1,500
3-Compensation				
Rate—Per Cent of Earnings	50%	50%	50%	50%
Maximum, per Week	$10	$15	$15	$10
Minimum, per Week	$ 5	....	....	....
Number of Payments, Normal	1 for 4 weeks of service	1 for 3 weeks of service	16 weeks	Based on service
Maximum	10 weeks	16 weeks	....	....
Uncompensated Waiting Period	2 weeks	3 weeks	3 weeks	4 weeks
4-Contributions—Employers				
Rate of Payroll	2%	3%	2%	2%
Minimum Employee Reserves	$55	$65	Pooled fund	$40
New Rate	1%	1%	....	1%
Maximum Employee Reserves	$75	$100	....	$75
5-Contributions — Employees	No	May	1%	....
6-Type of Reserve Fund				
State	Yes	Yes	Yes	....
Industry	May	May	....	Yes
Plant	May	....	....	Yes
Individual Accounts	Yes	Yes	Yes	Yes



Production line at the San Francisco plant of the Tea Garden Products Company

It takes nine people to label, inspect, and pack jars of jam. They are at work because technological development has provided filling, capping, labeling, and handling equipment that keeps manufacturing costs low. Result: Low prices, jam on more breakfast tables, and many more than these same nine people gainfully employed

Those Power Wastes

"The responsibility is management's" we have said and now repeat. Regard these age data as indicative of obsolescence

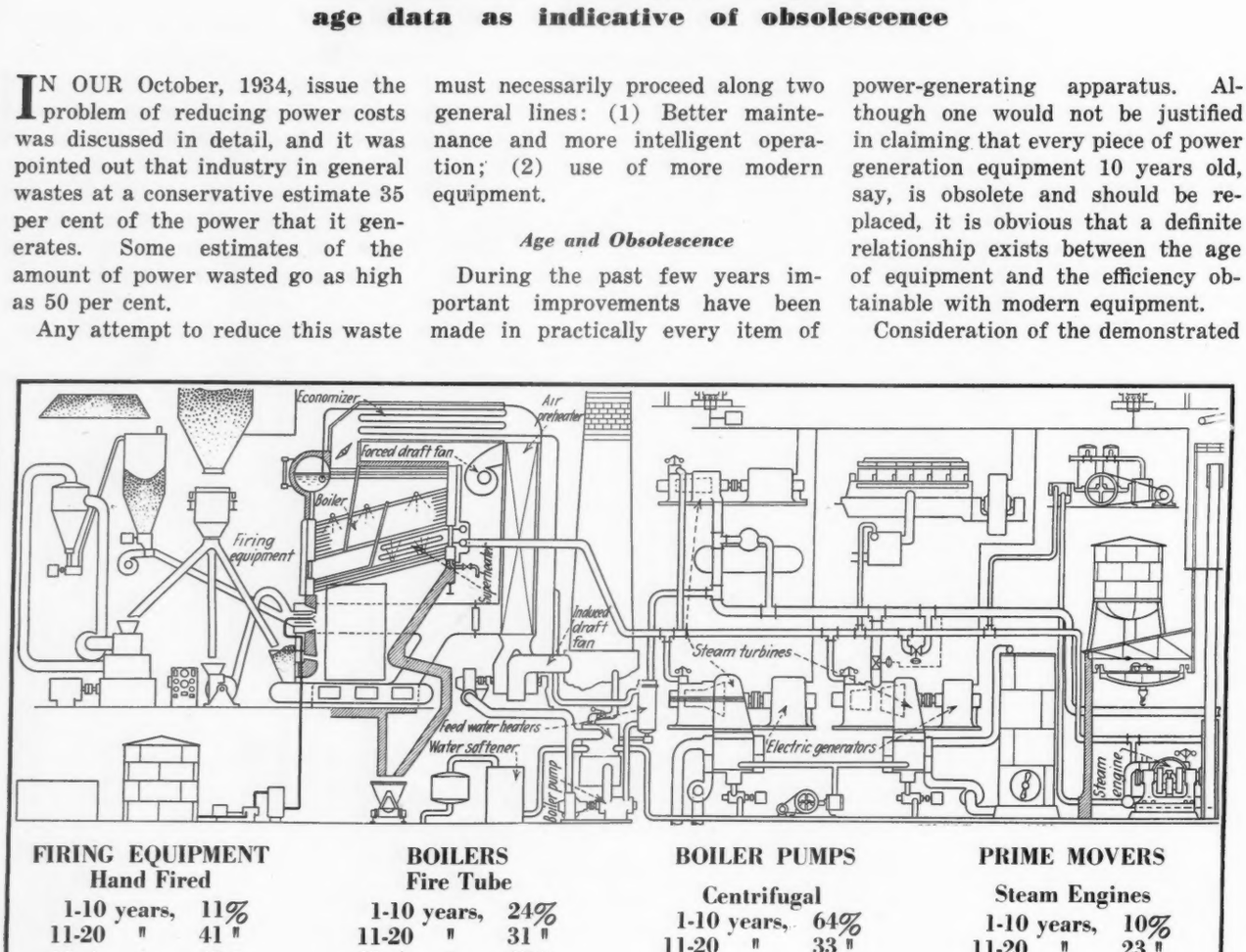
IN OUR October, 1934, issue the problem of reducing power costs was discussed in detail, and it was pointed out that industry in general wastes at a conservative estimate 35 per cent of the power that it generates. Some estimates of the amount of power wasted go as high as 50 per cent.

Any attempt to reduce this waste must necessarily proceed along two general lines: (1) Better maintenance and more intelligent operation; (2) use of more modern equipment.

Age and Obsolescence

During the past few years important improvements have been made in practically every item of power-generating apparatus. Although one would not be justified in claiming that every piece of power generation equipment 10 years old, say, is obsolete and should be replaced, it is obvious that a definite relationship exists between the age of equipment and the efficiency obtainable with modern equipment.

Consideration of the demonstrated



FIRING EQUIPMENT

Hand Fired

1-10 years,	11%
11-20 "	41 "
20 + "	48 "

Hand Stokers

1-10 years,	22%
11-20 "	61 "
20 + "	17 "

Automatic Stokers

1-10 years,	31%
11-20 "	45 "
20 + "	24 "

Pulverizers

1-10 years,	91%
11-20 "	9 "

Oil Burners

1-10 years,	49%
11-20 "	32 "
20 + "	19 "

Gas Burners

1-10 years,	39%
11-20 "	25 "
20 + "	36 "

BOILERS

Fire Tube

1-10 years,	24%
11-20 "	31 "
20 + "	45 "

Water Tube

1-10 years,	34%
11-20 "	40 "
20 + "	26 "

ECONOMIZERS

1-10 years,	40%
11-20 "	40 "
20 + "	20 "

WATER SOFTENERS

1-10 years,	69%
11-20 "	29 "
20 + "	2 "

AIR PREHEATERS

1-10 years,	97%
11-20 "	3 "

SUPERHEATERS

1-10 years,	41%
11-20 "	42 "
20 + "	17 "

BOILER PUMPS

Centrifugal

1-10 years,	64%
11-20 "	33 "
20 + "	3 "

Reciprocating

1-10 years,	33%
11-20 "	43 "
20 + "	24 "

FEED WATER HEATERS

1-10 years,	43%
11-20 "	40 "
20 + "	17 "

FORCED DRAFT FANS

1-10 years,	59%
11-20 "	37 "
20 + "	4 "

INDUCED DRAFT FANS

1-10 years,	61%
11-20 "	34 "
20 + "	5 "

PRIME MOVERS

Steam Engines

1-10 years,	10%
11-20 "	23 "
20 + "	67 "

Steam Turbines

1-10 years,	51%
11-20 "	37 "
20 + "	12 "

Waterwheels

1-10 years,	26%
11-20 "	35 "
20 + "	39 "

ELECTRIC GENERATORS

Alternating Current

1-10 years,	47%
11-20 "	41 "
20 + "	12 "

Direct Current

1-10 years,	32%
11-20 "	39 "
20 + "	29 "

This chart is a reproduction of part of the Power Loss Check Chart published in October, 1934, FACTORY MANAGEMENT AND MAINTENANCE

waste of power in industrial plants naturally leads to the question: How much of this waste is due to obsolete equipment?

It is difficult, perhaps impossible, to give a definite answer. On the other hand the age of the power generation and associated equipment now in use can be determined accurately for at least a selected list of plants. This important task has been undertaken by *Power* and the results obtained in its survey are summarized here.

The study did not include central stations; the data apply only to industrial power plants. In conducting the survey, industry was divided into fourteen major groups. Equipment was reported in three age groups—1 to 10 years old, 11 to 20 years old, and more than 20 years old.

Data were obtained on 24 kinds of equipment, covering more than 13,000 items, from 454 plants which are larger than average size and presumably better equipped and operated. They represent 9.2 per cent of industry prime mover horsepower. Of these plants, 38 per cent have planned to modernize their equipment.

Age of Power Generation Equipment in 454 Plants in 14 Major Industries

Industry	*Ages in Years*		
	1 to 10	*11 to 20*	*20 plus*
Food	24%	33%	43%
Textiles	20	43	37
Forest products	38	26	36
Paper	31	44	25
Chemicals	44	46	10
Petroleum and coal products	39	53	8
Rubber	23	60	17
Leather	27	42	31
Stone, clay, glass products	51	27	22
Iron and steel	18	33	49
Non-ferrous metals	18	51	31
Machinery	23	40	37
Transportation equipment	39	39	22
Miscellaneous	42	29	29

Here Are the Facts

Starting with boilers, the heart of the power plant, it was found that 24 per cent of the fire tube boilers are from 1 to 10 years old, 31 per cent are from 11 to 20, and 45 per cent more than 20. Of the water tube boilers surveyed, 34 per cent are from 1 to 10 years old, 40 per cent from 11 to 20, and 26 per cent more than 20.

Of hand-fired grates, 11 per cent are in 1-to-10-year age group, 41 per cent in the 11-to-20 group, and 48 per cent are more than 20 years old. Hand stokers make a better showing: 22 per cent are from 1 to 10 years old, 61 per cent from 11 to 20, and 17 per cent more than 20.

Automatic stokers: 31 per cent from 1 to 10 years old, 45 per cent from 11 to 20, and 24 per cent more than 20. Pulverizers seem to be relatively newer: 91 per cent are from 1 to 10 years old, and 9 per cent from 11 to 20.

Almost half of the oil burners, 49 per cent, are from 1 to 10 years old, 32 per cent from 11 to 20, and 19 per cent more than 20. Thirty-nine per cent of the gas burners are from 1 to 10 years old, 25 per cent from 11 to 20, and 36 per cent more than 20.

As might be expected, steam engines show a greater average age than do steam turbines. Ten per cent of the engines are from 1 to 10 years old, 23 per cent from 11 to 20, and 67 per cent more than 20.

For steam turbines the figures show that 51 per cent are from 1 to 10 years old, 37 per cent from 11 to 20, and 12 per cent more than 20.

In the plants surveyed 202 waterwheels are in use. Of these, 26 per cent are from 1 to 10 years old, 35 per cent from 11 to 20, and 39 per cent more than 20.

Slightly less than half, 47 per cent, of the alternating-current generators are from 1 to 10 years old, 41 per cent from 11 to 20, and 12 per cent more than 20. Direct-current generators range from 32 per cent 1 to 10 years old and 39 per cent from 11 to 20, to 29 per cent more than 20 years old.

Make Your Own Comparisons

Comparison of the age of power generating equipment in the different industry groups is interesting, and can be made from the table.

Aside from data on the age of equipment, the survey throws some light on the conditions and practices in the plants studied. For example, 81 per cent use process steam, and 96 per cent use steam for heating. This condition would indicate, in general, plants that generate large amounts of power as a byproduct.

Sixty per cent of the plants weigh the boiler fuel; 67 per cent convey the fuel mechanically; 37 per cent convey the ash.

Steam meters are used in 71 per cent of the plants to check the boiler room output, in 53 per cent to measure the consumption of engines and turbines. In 69 per cent of plants the process steam is metered, and in 62 per cent the feed water is measured.

Of the electrical energy used in these plants 75 per cent is generated, and 25 per cent purchased. It should be noted, however, that this proportion would not hold true for all of industry.

Draw Your Own Conclusions

Whether the showing which this cross-section of industry makes in respect to its power generation equipment may be considered good, depends on definition of terms and on one's viewpoint. There can be little dispute that there is plenty of room for improvement. In 9 of the 14 major industries more than 25 per cent of the power generation equipment is more than 20 years old. This can only mean that such equipment, if not utterly obsolete, is operating at an efficiency that is much below the mark attainable by present-day devices, and entirely out of tune with today's requirements.

•

Kohler Workers Win

BECAUSE so many people still seem to be wondering about the outcome of the union drive on the Kohler Company, Kohler, Wis., with the resulting "strike" and attendant violence, it is in order to add to the record a somewhat belated report of the government-supervised election held September 27.

With 92 employees not voting, 1,063 unchallenged votes were counted for the Kohler Workers' Association, 643 for Federal Union No. 18,545. In addition, 370 challenged votes were cast for the Association, 188 for the Union. Five were void, 24 sealed for further consideration.

You Want to Know

. . . and the editors will gladly tell you . . . more about the things mentioned on this page

• FIRST COME, first served. *Factory* has a limited supply of two new pamphlets on "Unemployment Reserves" — (1) Study-outline, pertinent questions; (2) opinions and suggestions, lessons from British experience.

• EXPANDING, lubricated hinge pin keeps hinges from squeaking. For auto doors, other uses.

• THIRTY-HOUR WEEK — background, underlying philosophy, analysis of philosophy, effect of prices, effects on various economic classes. A new 20-page study published January 3.

• WRITE in the dark, if you must, with a flashlight pencil.

• VIBRATING FEEDER, electric, moves bulk materials uphill, on the level, downhill. Countless applications.

• "FACTS about unemployment compensation," a report of much that you need to know boiled down into 10 pages.

• DESIGNED especially for barrel handling, a new portable elevator.

• FIREPROOF wallboard, made of asbestos and portland cement, comes in colors, plain or scored sheets. Can be sawed and nailed like wood.

• THREE-TIER letter tray, plastic molded. Each tray swings 180 degrees. Easy to get at contents.

• DEVICE which adds a special solvent to typewriter ribbons while in the machine restores them to original efficiency, prolongs life.

• ELECTRICAL attachment plugs with flexible spring action won't come loose.

• PERPETUAL inventory tags are offered by screen cloth manufacturer to dealers. Tags have scales marked off in lineal feet. As the dealer sells the cloth, he marks tag or cuts off a section. What's left of the tag shows what's left of the cloth. An idea you can adopt?

Collapsible, re-usable, this container requires no nailing, holds more because it needs no center partition, weighs 5 pounds less than the ordinary box. Saves 33 per cent in packing costs, 10 per cent in freight. Used already for motor parts, grapefruit. Has many other industrial applications

• ISOLATION CORKBOARD, developed to control and eliminate unnecessary noise and vibration, has greater density than ordinary corkboard in order to withstand machinery loads.

• APPLIANCE COIL. It fits in a wall receptacle. Automatically released cord adjusts itself to any length up to 6 feet.

• COMMERCIAL CALCULATOR quickly solves problems in interest, wages, costs, prices, discounts, etc. A handy gadget to have around.

• SURFACE TREATMENT, new, penetrates concrete, fills and seals the surface pores, increases floor life, can be applied without interrupting production.

• DARK BLUE GLASSES in the form of a filter and lens arrangement are now being worn by the electric eye on a paper classification job.

• BLACK ALUMINUM pistons. They absorb a little oil, resist scuffing, live longer.

• SOMEONE asks why not an aluminum-paper-backed clothes bag? Somebody's opportunity, perhaps.

• MOLDED screw-caps, believe us, cost only about 3 mills per bottle more.

• CARBON MONOXIDE alarm rings an electric gong when the amount of CO in the air reaches a dangerous point.

• WHEN you control humidity, you control *effective* temperature. So a compact unit, just developed, that does an air conditioning job without the expense of mechanical refrigeration.

• POTATO CHIPS in aluminum-foil sacks stay crisper longer, tests show.

• POTATOES, too, come in fancy packages, or anyway in convenient cartons. Merchandising masterminds say they suggest larger unit sales.

• GOGGLE LENSES of toughened glass do no cutting if they break—as they seldom do, because they pass twice the shock resistance demanded by government specifications.

• PACKAGING SHOW for 1935 will be in Chicago, March 5 to 8. Entries for Wolf Award must be received prior to February 4.

• SOUNDS TRICKY, but ain't. A better tablet package is just a flat molded piece with a metal slip cover. The plastic piece has holes in it with slight projections at the bottom edge of each hole to keep the tablets in place. To use, slide back the cover and push up.

• FABRIC woven of manila rope fiber has tremendous strength, should find plenty of industrial uses.

OPERATING SHORTS

Holder for Hoisting Heavy Packing Cases

W. S. WHITING, JR., *Superintendent Textile Cone Department, Champion Fibre Co., Canton, N. C.*

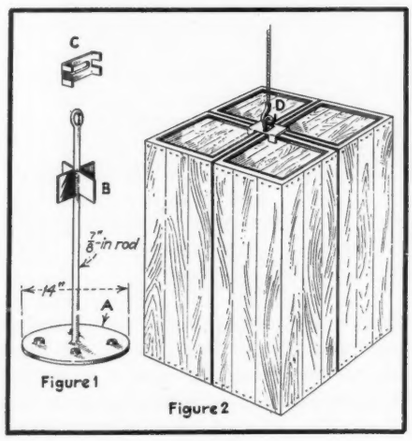


Figure 1

Figure 2

Faced with the problem of lowering cases of cones from the window of a packing room on the second floor of a building to a storeroom on the first floor, we designed the holder shown in the illustration.

The cases, approximately 4 feet high and 2 feet square, contain about 300 pounds each of cones. The monorail hoist has very little headroom, going through the window, so that aside from mashing the edges of the plywood cases no arrangement of the sling was satisfactory for handling more than one case at a time. The device shown is easily made and handles four cases at once.

It consists, Figure 1, of a $\frac{7}{8}$-in. rod fastened to a plate, *A*, which is made of $\frac{3}{16}$-in. metal about 14 inches in diameter. The rod is headed underneath the plate and arc-welded on the top to give a rigid and dependable connection. Square pieces of $\frac{1}{8}$-in. metal, *B*, are welded at right angles to hold the edges of the cases. *C* is a piece of $\frac{1}{8}$-in. metal cut to slip over the eye and having bent-over legs to hold the cleats on the cases, as shown at *D* in Figure 2. On baseplate *A* are four $\frac{3}{4}$-in. nuts welded in place to hold the bottom cleats of the cases.

Loaded cases are easily wheeled by hand into the position shown in Figure 2, and when the lock plate *C* and hoist hook are in position the cases cannot, without being completely demolished, get loose from the device.

Mr. Whiting's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

•

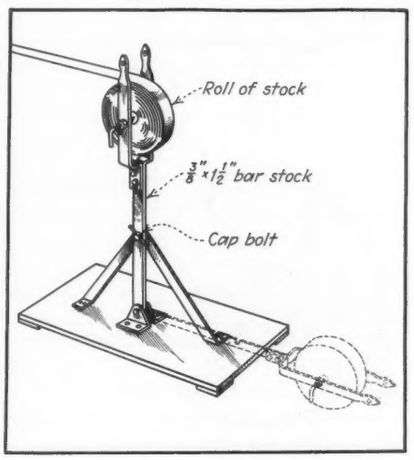
Loading Stand for Coiled Stock

CHAS. H. WILLEY
Penacook, N. H.

Rolls of coiled brass stock up to 6 inches in width and weighing from 30 to 70 pounds are handled with ease in our plant on the one-man loading stand shown in the sketch.

The stand is made of $\frac{3}{8}$-in. steel bar stock $1\frac{1}{2}$ inches wide. Coils turn on a mandrel with a center. At the lower end the upright is hinged to the bracket. The upright is clamped to the brace with a cap bolt having a pin through it, the upright being slotted as shown.

When loading the stand the cap bolt is loosened and the forked end swung down to the floor. The coil is rolled into place and the screws adjusted to the mandrel. Then the operator grasps the two handles, raises the load up and tightens the bolt in the brace.



Shoe-Store Ladder for Tool Crib

JOHN A. HONEGGER, *New York*

Remember the rolling ladders in the shoe stores of yesterday? A plant in the East is using one of them very effectively to solve a bothersome storage problem.

A tool crib was needed; little floor space was available. But the ceiling, 12 feet high, was the vertical limit.

Walls were therefore erected and divided into compartments of suitable sizes so that the heavier tools and accessories could be stored near the floor.

Location symbols and tool record cards were next provided. Thus, to store a drill jig, the tool number and name of the jig were entered in the record; opposite these data the location, as A6 or Z64, was set down.

How to get at the higher compartments was the final question. Someone thought of the rolling step ladder that was so useful in the shoe store of not so many years before. A mill supply dealer was consulted and a ladder purchased. It paid for itself in no time.

•

One Way to "Un-Freeze" Frozen Materials

A winter day. A hopper or gondola-type car, loaded with cinders, gravel, crushed stone, coal, or what have you. Orders to unload it quickly as possible. You find that the material is frozen at the hopper or chute, preventing the unfrozen portion from running out. It is dangerous to put a man under the car to loosen it. What to do?

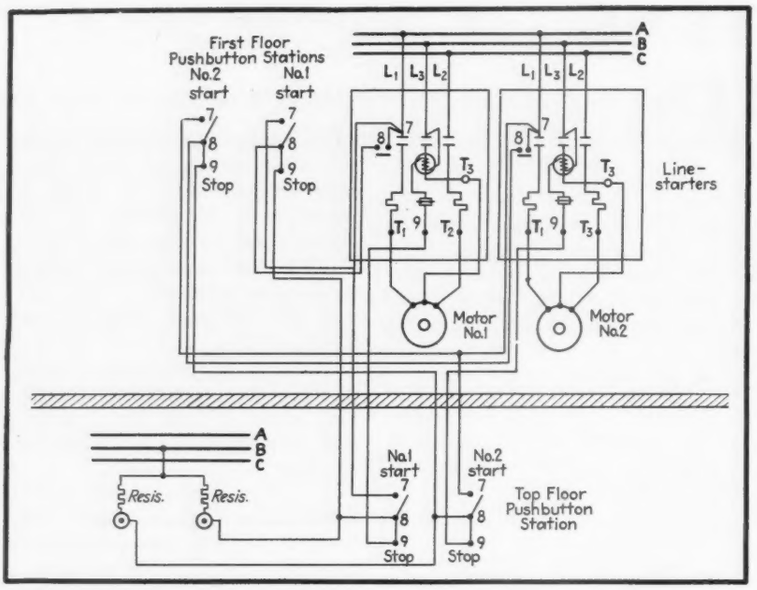
Make a hole big enough to receive a dynamite cartridge, and just deep enough to shatter the frozen material. No damage will be done to the car if the job is correctly done. Explicit instructions for this kind of blasting can be obtained from manufacturers of explosives.

•

Indicating Lamps for Motor-Driven Pumps

E. M. CURTIS, *Chief Electrician Gulf States Paper Corporation Tuscaloosa, Ala.*

In a number of instances our motor-driven pumps and their starting equipment are located several



floors away from the operator. At the same time it is always advisable, often necessary, that the operator know when certain pumps are running.

The diagram shows how indicating lamps have been cut into the control circuits of the pump motors. These lamps are lighted only when the corresponding linestarter is closed. Any suitable lamp receptacle can be used, with the proper resistance. The regular switchboard lamp indicators have been found to be very satisfactory.

One terminal of each pilot lamp resistor must be connected to the No. 8 terminal of the push-button station. The other terminal of the resistor has to be connected to the same phase as the holding coil of the starter.

When making repairs on the starters it is necessary to unscrew the indicating lamps; otherwise there will be a feedback through the control wires.

•

Better Product Cost Less

In the manufacture of stair materials and parts, plain cylindrical handrail in long lengths was stocked and cut as needed. An ornamental end always was used, the acorn-shaped terminal being the most popular.

It was quite a problem to turn an acorn on the end of a long rail. Then someone began using the lathe to turn out acorns with tenons, bored the handrails to receive them, and made glued assemblies. Three advantages accrued: A more economical machining method; scrap stock made into acorns; acorns and rails of contrasting color can be used.

•

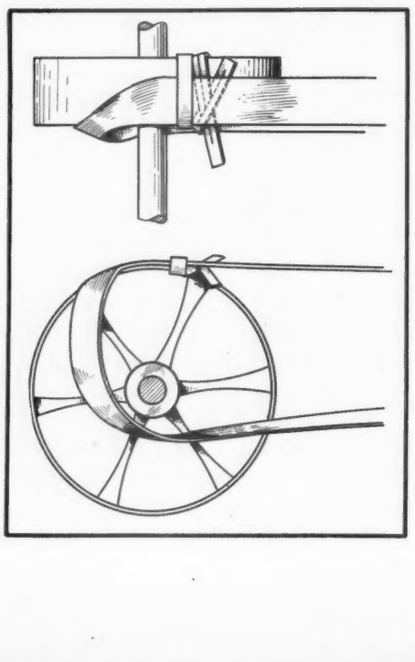
Wolverine Tube Company, Detroit, installed a controlled atmosphere electric furnace last August to bright-anneal copper tubing, reports better quality, lower heat-treating costs, more sales.

•

Easy Way to Put Tight Belt on Pulley

H. MOORE, *Hamilton, Ont., Canada*

When placing a tight belt on a pulley, a beltman whom I saw recently used a short length of belt



that was slit through the middle to within about 4 inches of each end.

He wrapped this slit belt over the tight belt, which was resting on the pulley, and crossing it inside the rim of the pulley brought the ends up and passed one end through the slit, drawing both ends tight beneath the belt. When the shaft was revolved slowly the belt pressed down so tightly on these joined ends that no slipping was possible and the belt was forced onto the pulley.

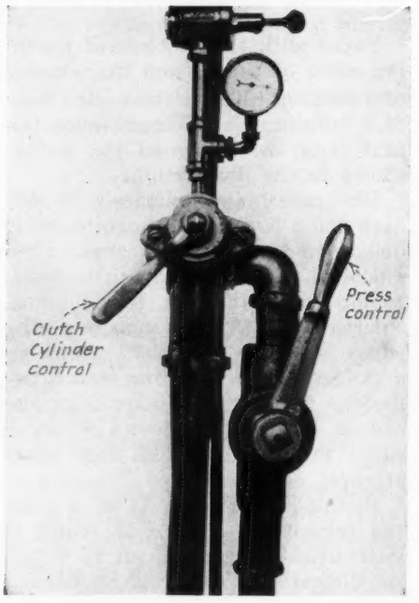
•

Pneumatic Control for Hydraulic Press Pump

K. D. VOSLER, *Factory Superintendent, Edo Aircraft Corp. College Point, N. Y.*

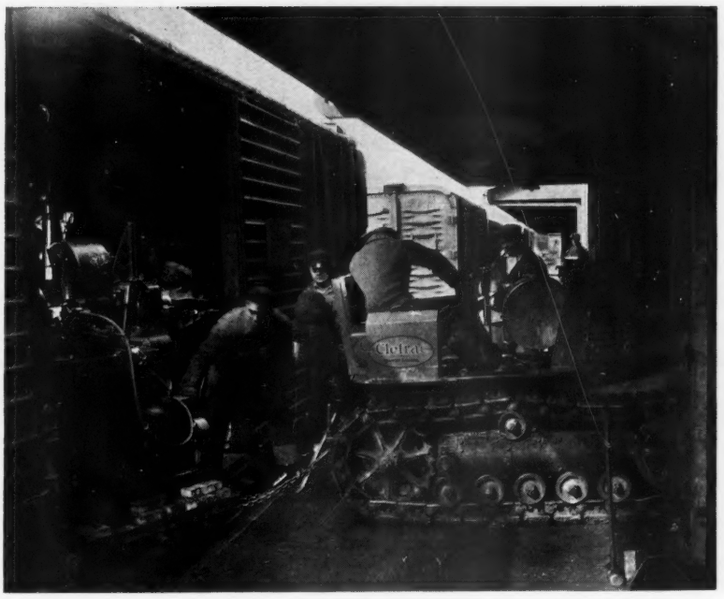
When installing a 260-ton hydraulic press it was found necessary to locate the three-stage pump in a subbasement, approximately 30 feet distant from the press.

In order that the press operator might control the pump clutch from his position at the press, a 1-inch bore, double-acting air cylinder having a stroke sufficient to move the



clutch handle through its required travel was installed on the pump. This cylinder is controlled by an air valve located directly above the hydraulic pressure control handle at the press, as shown.

With this arrangement the operator is not required to leave his position for either pump or pressure control. It provides a very efficient and accurate method of controlling the system.



Cheaper to Move

REGINALD TRAUTSCHOLD
Pompton Plains, N. J.

When the National Acme Company moved 180 carloads of machine tools and equipment from its Windsor, Vt., plant to its Cleveland factory, two tractor and skidplate units were used to hasten the transfer and hold down the cost. At Cleveland, all the machinery was unloaded from the box cars and placed in position in sixteen days. Within the month, the tractor-skidplate carriers effected net savings amounting in the aggregate to twice the entire outlay entailed in their purchase.

•

Chilly corners in your plant needn't be chilly. Try electric space heaters.

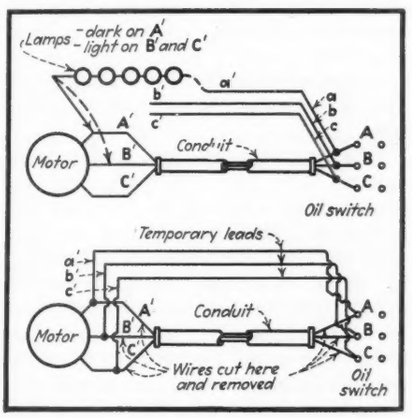
•

Had to Move Conduit Couldn't Stop Motor

J. E. WRIGHT, *Montreal, Canada*

A run of conduit containing cables that fed a 550-volt motor driving an exhaust fan had to be removed to make way for a new generator. Since neither the boilers nor the fan could be shut down, the following method was used in removing the conduit.

Three temporary leads, *a*, *b*, *c*, were run from the oil switch to the motor terminals, as shown in the diagram, and a lampbank consisting of five 110-volt lamps connected in series was used to phase out these leads from the oil switch with the motor leads. First, leads *a*, *b*, *c*, were soldered to terminals *A*, *B*, *C*, on the oil switch. The other ends, marked *a'*, *b'*, *c'*, were secured to prevent an accidental short. With



the fan in operation one motor terminal lead was untaped and one wire from the lampbank was attached to it, the other wire from the lampbank being touched in turn to leads *A'*, *B'*, *C'*. The temporary lead that did *not* light the lamps when touched with the free test wire, was then soldered to the untaped motor terminal.

The same procedure was followed with temporary lead *B*-*B'*. Then the remaining lead, *C*-*C'* was connected to *C'*, the motor terminal.

As each temporary lead, for example *a'*, was connected to the proper motor terminal the old lead, *a*-*a'* was cut at the switch and motor terminals respectively and the ends taped. After this had been done with the other two temporary leads the conduit with the old leads was removed.

Laying Out Angles

Two rules of the 24-in., four-fold type can be used in laying out angles with approximate accuracy. Use one rule to measure from leg to leg of the other rule partly opened. Certain measurements yield certain angles. Scratch the data showing corresponding measurements and angles into the raw wood, mark them permanently with waterproof ink, shellac when dry.

•

Handy Sandpaper Block for Smoothing Commutators

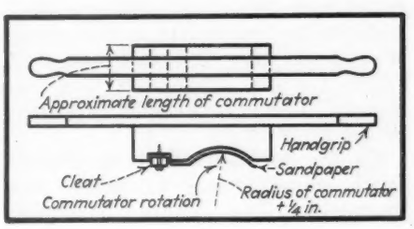
J. L. YOUNG, *St. Marys, Ohio*

Illustrated is a simple device for removing the small grooves that form in the surface of commutators, leading to serious roughness and consequent commutation and brush troubles.

It consists of a wood block, with a suitable handle, for holding a few sheets of sandpaper. The block is squared so its width will be about equal to the length of the commutator. It may be any convenient length somewhat greater than the commutator diameter.

As will be seen, the curved surface is cut closer to one end of the block in order to provide space at the other end for a cleat by which several strips of sandpaper can be secured. The curve should be cut to a radius equal to the radius of the commutator plus ¼ inch. This will give ample space for the sandpaper and insure good contact with the commutator surface. Attaching several strips of sandpaper to the block at a time serves the dual purpose of providing a cushion effect for the cutting strip and avoids the necessity of putting on a new piece when one wears out. The worn strip is simply torn off.

Only one end of the sandpaper is fastened to the block by a small wood cleat fitting into a dado, thus allowing the sandpaper to adjust itself to the curvature of the commutator. The slack due to stretching of the sandpaper works out to the loose end, preventing the tearing which

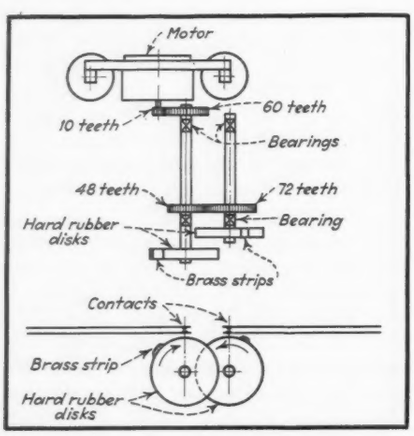


otherwise would occur. The commutator must always rotate in the direction indicated so that the pull on the sandpaper is away from the end that is fastened.

For smoothing commutators ordinary sandpaper is preferable to emery cloth, since the dust from the latter is likely to damage the windings, and is much harder to remove after a job has been completed. The number or grade of sandpaper selected depends upon the condition of the commutator surface. Usually a job must be started with a relatively coarse paper and finished with a fine grade. Compressed air should be used for blowing out any grit that may have worked into the windings.

•

Timing Device for Process Control



CARTER N. PADEN, *Engineer*
Holfast Rubber Company, Atlanta

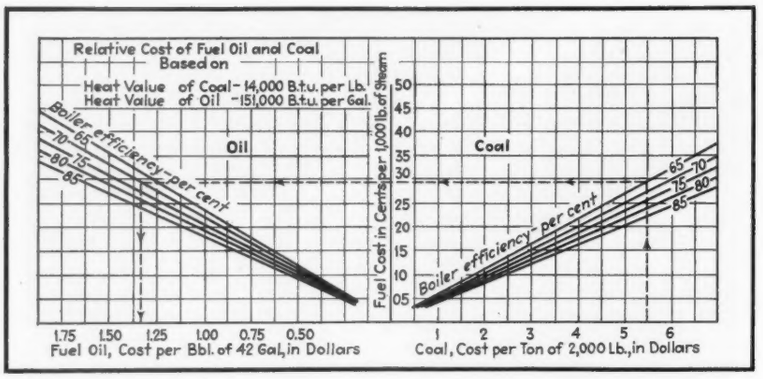
When our factory started to make full-molded inner tubes it became necessary to devise some method of controlling accurately the length of time that the tubes stayed in the vulcanizer. This meant automatic timing of two periods of different length.

In the back of an old meter box measuring approximately 6x8 in. was mounted a small, self-starting, 110-volt, single-phase, 60-cycle synchronous motor. Having an inbuilt gear train the speed of the motor shaft was 1 r.p.m. Using three small gears and two hard rubber discs fastened to two shafts a disc speed of $\frac{1}{8}$ r.p.m. for one disc and 1/9 r.p.m. for the other disc was obtained. The arrangement is shown in the illustration.

On the periphery of both discs a short, curved piece of brass was mounted. The length of these pieces was calculated so that it takes 10 seconds for them to pass a given point. The strips were fastened securely to the rubber discs and serve as cams to close an electrical contact.

The contacts are two small, flat springs with platinum points in the ends, which were taken from an old telephone jack. These sets of springs with the contacts normally separated a short distance were mounted against the surface of the hard rubber discs in such position that the brass strips on the discs will close the platinum points. A 110/6-volt transformer and two bells were the only other items of equipment needed. Bells of different tone were used so that the operator will know which time cycle has been completed.

Length of time the alarm bell sounds can be extended or shortened by lengthening or shortening the brass strips on the periphery of the hard rubber discs. To vary the time cycle it would be necessary to change at least one gear.



Fuel Costs with Coal and Oil

K. B. KEEFER, *MacDonald Bros., Inc. Boston, Mass.*

The accompanying chart provides an easy method of determining whether coal or oil is the most economical fuel, as well as the savings that might be obtained if a change were made.

An example will show how the chart is used. Following the dotted line, it will be seen that coal delivered at $5.50 per 2,000-pound ton, assuming a boiler efficiency of 65 per cent, results in a fuel cost of $0.295 per thousand pounds of steam. This same fuel cost for oil, with a boiler efficiency of 70 per cent (oil usually gives slightly better efficiencies) is equivalent to fuel oil at $1.33 per 42-gallon barrel.

SPECIAL NOTICE

$10 will be paid for the best Operating Short submitted by the 25th of January. The Editors are the judges. Other Shorts accepted will be paid for at attractive space rates

They Are Getting Better Cores

They were drying cores by gas in an Ohio foundry at a cost of about $5 for an 8-hour dry. A stoker was installed.

In the first place, it saves money. Coal in 1-ton lots costs the company $4.75, is approximately $1 a ton cheaper in carload lots. The stoker burns 600 pounds in an 8-hour cycle.

Second, the dry is better. Gas contains about 20 per cent moisture, which had to be driven out before cores could be thoroughly dried.

In short, they are getting better cores in less drying time at less expense.

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Central heating plant at Mount Holyoke College, South Hadley, Mass., consists of 120 domestic oil furnaces arranged to operate automatically in a single battery. Heats 24 buildings. An idea for industrial plants?

Off-Peak Power Saves $7,000

During winter months this concern draws no power from the line between 4:30 and 7:30 p.m., makes its own instead

N. T. PEF
Chicago

THERE are many ways of cutting power costs. Some industrial concerns have been able to reduce them by purchasing power instead of generating it; others by changing from purchased to generated power.

Sometimes it is more economical to purchase part of the power required and generate the remainder. In some parts of the country money can be saved by changing from coal to oil; in other places the reverse is true. Also, there are places where natural gas is the thing.

No General Panacea

There is no panacea for power cost reduction that is applicable to all cases, or to any one case all the time. In this rapidly changing world every department of business rests upon a thousand variables, any one of which may destroy the equilibrium.

This situation is especially true of power plants because of the many technical developments that have been and are constantly being made. A power plant that was built a few years ago and designed for the lowest possible costs under the assumed conditions may not be the answer today. The only way to meet this condition is to keep informed on what is going on and make adjustments in the right direction.

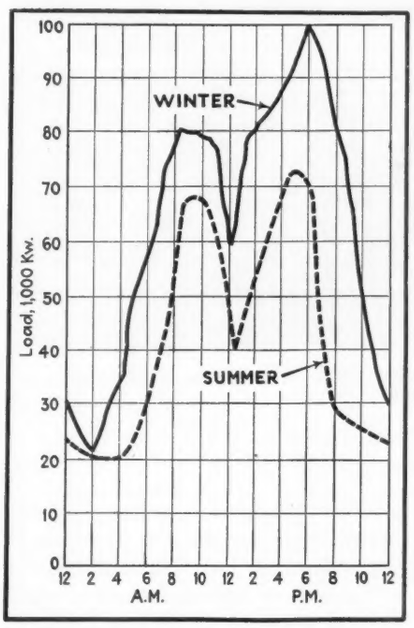
The power plant of a certain factory was originally designed to generate all the power and supply all the steam required. At the time the plant was built this arrangement resulted in the lowest power cost.

Equipment of the power plant consists of three 250-kva. engine-driven generators and three 300-hp. boilers. The maximum load is 500 kw., and the monthly energy consumption amounts to 50,000 kilowatt-hours.

Some years later the steam requirements had changed; more high-pressure and less low-pressure steam was needed. Also, there had been a reduction in the rates for purchased power. So it became more profitable to shut down the generating equipment and purchase power.

The energy cost of purchased power is 1.2c. a kilowatt-hour, and the total yearly cost was:

Energy cost, 600,000 kw.-hr. @1.2c.	$ 7,200
Demand charge, 500 kw.@$2 a kw. a mo.	12,000
Total cost	$19,200



Load on a typical generating station

Later, new rates for peak and off-peak power suggested the present plan of operation, which has resulted in a saving of more than $6,500 a year.

The chart, which shows the load on a typical generating station, will help to make clear the meaning of the terms peak and off-peak power. It will be seen that the winter load is much the heavier and that it reaches a maximum between about 4:30 and 7:30 p.m.

Avoiding the Peak

This period during the four winter months is the peak. If purchasers of power do not use any current during the peak they can secure lower rates. For example, the demand rates available in this instance are:

1. Off-peak, $0.78 a kilowatt a month.
2. Peak $2.00 a kilowatt a month.

This means a saving in the demand rate of $1.22 a kilowatt a month.

Under the new plan, during the four winter months the company does not draw any current from the power line between the hours of 4:30 and 7:30 p.m., but runs its own generating equipment. The output is 80,000 kw.-hr. a season.

The yearly cost of power under the present plan is:

Energy cost (520,000 kw.-hr.) @1.2c.	$ 6,240
Demand charge@$0.78 a kw. a mo.	4,680
Additional labor and fuel cost	1,500
Total cost	$12,420

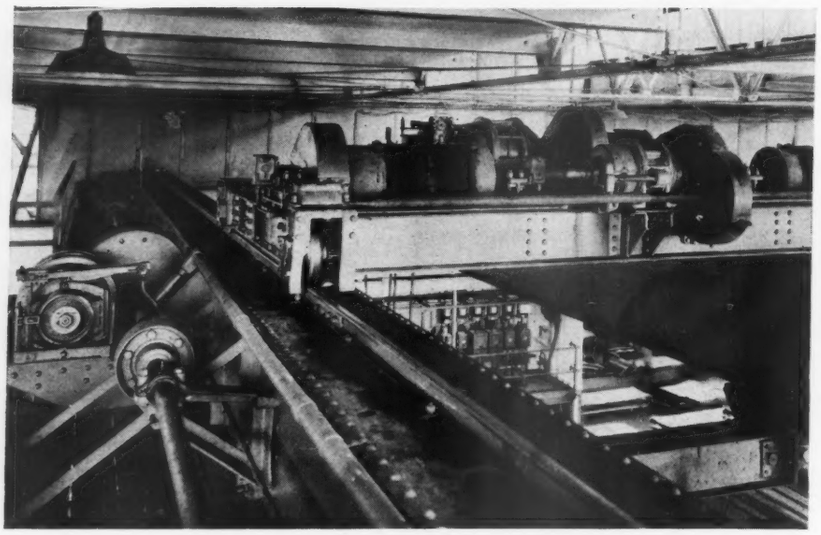
The yearly saving is $19,200 — $12,420, or $6,780.

The feasibility of operating the generating equipment at full load during the peak period, as at present, and generating as much power at other times as the demand for exhaust steam would justify, was given careful consideration, but since only a very small portion of the exhaust steam could be used, the saving was offset by the cost of labor. However, for plants that have generating equipment already installed, the greatest economy usually is obtained by generating power in proportion to the demand for exhaust steam, and purchasing the remainder.

Perhaps a Smaller Motor?

Horsepower rating depends on temperature rise; a smaller motor can be used in intermittent service because it has a chance to cool off

H. M. FRENCH
Industrial Engineering Department, General Electric Company
Schenectady, N. Y.



Motors for crane service are intermittent rated. Close-up of bridge crane at the Rome Brass & Copper Company

WHEN running at full speed a motor will deliver a certain horsepower continuously; it will have another horsepower output when operated for only two hours, still another when operated for one hour, and so on. Since no machine is 100 per cent efficient, some of the input watts are lost, and it is this energy that heats up the machine.

Most motors are physically able to deliver much more than their continuous-rated horsepower. Rated horsepower, then, is determined by the ultimate temperature reached by the insulation, which must not exceed a certain maximum if long life is expected. The rated horsepower of a continuous-rated motor is the greatest load that it can carry without heating the insulation over this limit, no matter how long that load is carried. An intermittent motor rating specifies the horsepower and the time that the load can be carried before the heating exceeds the guaranteed limit.

When the load is intermittent the motor cools during the low-load or no-load intervals. The total heating effect will be the equivalent of some intermittent rating such as 50 horsepower for 30 minutes.

Typical reduction in horsepower rating with lengthening of operating time is shown in Table I, which applies to mill-type, d.c. motors having an allowable temperature rise of 75 degrees Centigrade.

Temperature Rating

Standard rating for continuous-rated, open motors is 40 degrees Centigrade over a 40-deg. C. ambient or surrounding temperature. For inclosed motors it becomes a 55-deg. C. rise over a 40-deg. C. ambient. This ambient temperature was chosen because it is representative of average industrial conditions. Converted into degrees Fahrenheit, with which most people are more familiar, it represents 104 degrees, which in the majority of industrial plants is rarely attained, except in certain locations. Table II shows safe ultimate temperatures for insulation in both Fahrenheit and Centigrade readings.

As standardized by the A.I.E.E., short-time ratings for a.c. motors are 10, 15, 30, and 60 minutes. For d.c., synchronous, and fractional horsepower motors the ratings are 5, 10, 15, 30, 60, and 120 minutes. If a motor is assigned a short-time rating on a 1-hr. basis, it means that the motor will develop its full rated load for 1 hour without the winding temperature rise exceeding the definite, predetermined value.

Time On, Time Off

General-purpose motors, which have become so well known in industry, are all of the continuous-rated type. Hence, all intermittent-rated motors are classified as special, although their construction may be exactly the same as for continuous-rated motors.

In general, where sustained operation of 2 hours or more a day is required of a motor, a continuous-rated machine should be chosen. Under this figure, the ratio of time on to time off will be the deciding factor. If a motor is required to run for 2 hours, then stands idle for a half hour, then runs for another 2 hours, and so on, this service will require a continuous rating.

On the other hand, if a motor is required to operate for 2 hours in

Table I—How Horsepower Rating of D.C. Mill-Type Motors Varies with Time

Frame	*Horsepower*				
	15 Min.	*30 Min.*	*60 Min.*	*2 Hours*	*5 Hours*
402	7½	6½	5	4¼	3½
404	16½	13½	10	8½	6
406	24	19	15	11¾	7½
408	45	33	25	21½	13
410	62	45	35	27½	18
412	90	65	50	38	22½

Table II
Safe Ultimate Temperatures for Motor Insulation

Room Temperatures

Guarantee for Rise over 40 Deg.C.	Deg. C. 10	Deg. F. 50	Deg. C. 20	Deg. F. 68	Deg. C. 30	Deg. F. 86	Deg. C. 40	Deg F. 104	Deg. C. 50	Deg. F. 122	Deg. C. 60	Deg F. 140
40	50	122	60	140	70	158	80	176	90	194	100	212
50	60	140	70	158	80	176	90	194	100	212	110	230
55	65	149	75	167	85	185	95	203	105	221	115	239
60	70	158	80	176	90	194	100	212	110	230	120	248
70	80	176	90	194	100	212	110	230	120	248	130	266
75	85	185	95	203	105	221	115	239	125	257	135	275

Limit for class A insulation (cotton etc.) in open motors

Limit for class B insulation (mica and asbestos) in open motors

Temperatures in cross hatched areas are allowable for inclosed motors

the forenoon and 2 hours in the afternoon, it will usually be economical to use an intermittent-rated motor. The various combinations of off and on time are too extensive to be considered in detail here. As a general rule, unless the per cent of time off is equal to, and usually greater than, the per cent of time on, intermittent-rated motors should not be used.

Where to Use Intermittent Motors

In order to give some conception of the kind of job on which intermittent motors are used, the following applications may be cited:

Cranes and Hoists—Because of the character of the load, crane and hoist motors are always intermittently rated. Standard ratings for a.c. motors in this service are 30 and 60 minutes. Direct-current, series motors are rated 5, 15, and 30 minutes; the mill type, 30 and 60 minutes. These latter motors are given a 75-deg. C. rise rating, which accounts for the longer time rating.

Motor sizes in this service are usually selected on the basis of the root-mean-square of the load requirements. It involves determining the square root of the sum of the squares of the various parts of the duty cycle and then choosing the motor size nearest to the result.

Other applications of a similar character are found on cargo winches, car unloaders, ore unloaders, and the like.

Centrifugal Extractors—Laundry and sugar centrifugal extractors are excellent examples of intermittent-duty loads. Here the major part of the load is acceleration, since by the time the motor reaches full speed most of the liquid has been removed. Sugar centrifugals, in particular, require somewhat special motors since $1\frac{1}{2}$- and $2\frac{1}{2}$-min. duty cycles usually prevail. The accompanying curve (Figure 1) shows the character of this type of load. In this instance a two-speed motor is used, the lower speed being used for discharging the contents of the basket.

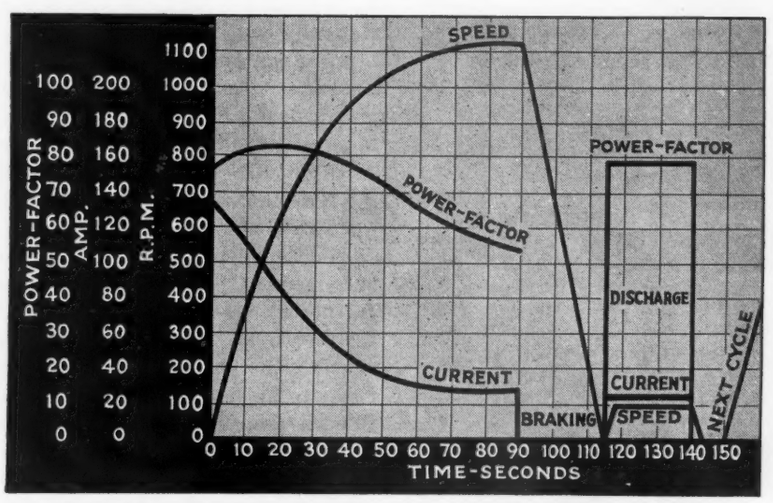


Figure 1. Operating curves of a two-speed motor driving a sugar centrifugal on a $2\frac{1}{2}$-min. duty cycle. High speed is used for extracting, low speed for discharging the contents of the basket

Bridges—Main driving motors on all types of movable bridges are usually of the high-torque, wound-rotor, induction type, rated 30 min., 55-deg. C. rise for inclosed motors; 30 and 60 min., 50-deg. C. rise for open motors. Lock and wedge motors on the leaves are usually given a 15-min. rating if inclosed and a 30-min. rating if open.

Valves—Valve motors are usually intermittently rated, the rating depending to a large extent on the service involved.

Furnace Doors—Motors used for opening and closing industrial furnace doors can be given intermittent ratings, since the duty is light.

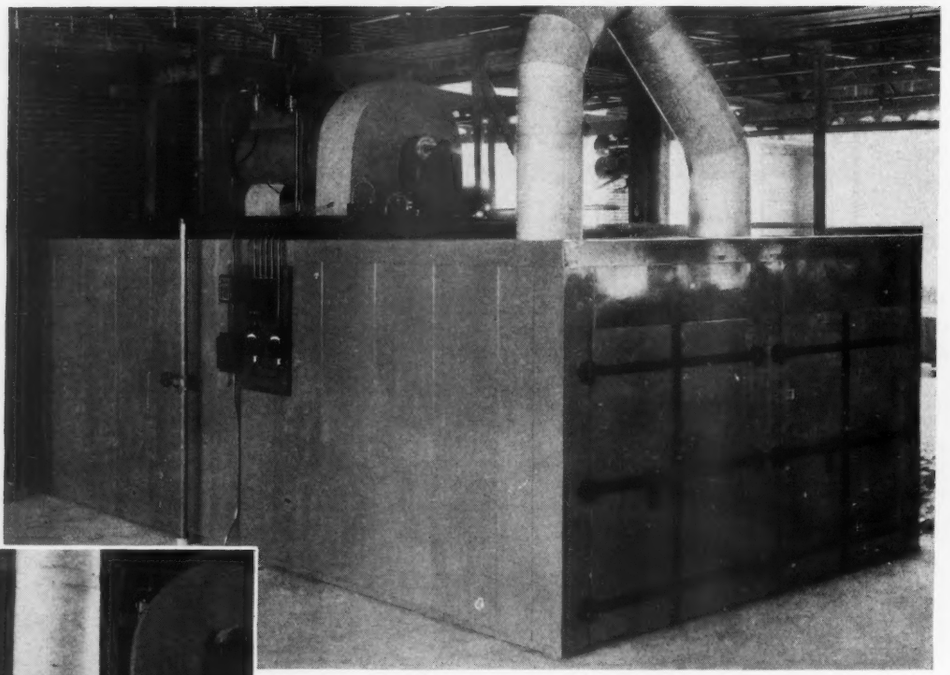
Steel Mills—Steel mills make extensive use of intermittent-rated, mill-type, d.c. motors for driving shears, live tables, screwdowns on rolling mills, and so on.

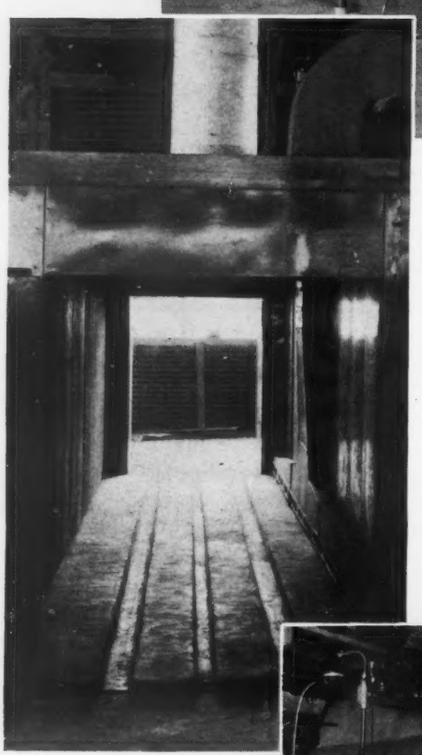
More for Equipment

CONDITIONS under which direct loans may be made to industry are being liberalized. Equipment purchases may be made with a larger proportion of the loan than formerly. It was found that by allowing the applicant the opportunity to replace obsolete equipment the prospect of repayment frequently is enhanced. The condition that the applicant show his ability to repay all the loan in five years is being waived in some cases, when ability to repay half the loan in that period can be shown.

These concessions are made chiefly to encourage participation in the loan by the applicant's bank. When a local bank has an interest in the loan the necessary surveillance is supplied automatically.

It has been found that the bank frequently declines to subordinate its outstanding loan to the new RFC loan. This is because bank examiners place such subordinated loans in the doubtful column. The practice now is to incorporate the bank's loan in the RFC loan with the bank participating in the entire loan.





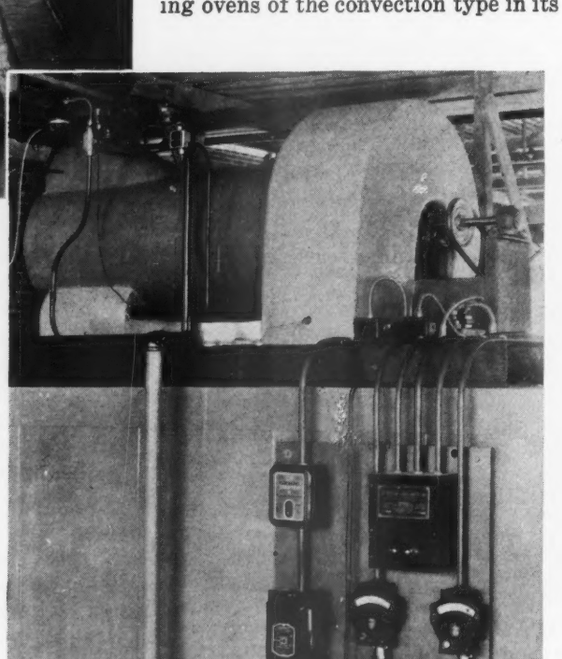
"We'll Use Gas"

Said this manufacturer

"NATURAL gas" is likely to be your guess on hearing the news that the York Wire Cloth Company has installed gas-fired rod baking ovens of the convection type in its newly completed plant in York, Pa.

Not so, however. Gas-fired ovens have been installed despite the fact that artificial gas of only 530 B.t.u.'s must be used instead of natural gas of practically twice the heat content.

The ovens are heated from a single source and a single fan through split ducts that are separately and automatically controlled. Oven temperatures range from 250 to 450 degrees Fahrenheit and are automatically maintained. For safety's sake there is an electronic flame-failure switch.



ONE photograph shows how the two ovens are heated from a single source through the split duct arrangement.

Another is a close-up of the temperature control instruments, acting on damper motors, that regulate the amount of heat delivered to each oven and maintain temperatures at predetermined values.

The third photograph shows you what an oven looks like inside. Note how the duct introduces the heat at floor level.

Telling Tales on Trouble

Every plant manager needs a mechanical tattletale or two. When troubles come, central supervisory systems announce them

H. R. KIRKLAND
President, H. R. Kirkland Company
New York

A DECEMBER article, "Extra Eyes for Executives," discussed the application of a supervisory system to the control of temperature, pressure, and humidity in industrial plants. The same general principles can be used for many other purposes.

For example, it is often highly important to have some means of indicating at a central point which one of several water flow riser valves has operated on a sprinkler system, showing the location of the area where the sprinkler head has opened. It is, of course, necessary that the riser valve be equipped with electric contacts. Devices to indicate water flow, which can be installed in an hour on a sprinkler system that is not provided with such contact-making equipment, are now on the market.

It is only necessary to drill a hole in the pipe and clamp the water flow indicator in place. These devices are fully approved by the Underwriters. Sprinkler alarm service can be obtained to a far greater degree than usually employed in the past, by installing these water flow indicators in the riser at each floor. In this way supervision can be provided that will indicate the riser location, and the floor on which a sprinkler head has been opened.

Detecting Fires

It may also be desired to indicate at a central point the location of a fire detector that has operated through an abnormally rapid rate of rise in temperature, or to indicate at a central point which one of a number of manually operated fire alarm stations has been actuated.

The wiring for each of these services is generally the same as for other services mentioned in this and the preceding article, except that closed-circuit instead of open-circuit wiring is desirable and an alarm bell (or bells) is usually employed on such systems in addition to the annunciator.

Under certain circumstances it is desirable to be able to tell at a central or sub-central point whether certain electric motors are operating.

Keeping Motors Running

Recently the executive member of a prominent Russian technical commission sought such a system in this country. In a certain department of one of their plants there are more than a hundred individually motored machines producing parts that are badly needed. It is important that no machine be out of service any longer than absolutely necessary. This official wanted to make it possible for a supervisor to know at once, while sitting at his desk, when any motor was cut off, so that the shut-down could be noted and timed.

A lamp annunciator was assembled, and a special transformer purchased for each motor to be checked. This small transformer reduces the operating voltage of the motor to a low value, making possible an inexpensive wiring job. (With direct current a form of resistor would have been required.)

When 120-volt a.c. power is used, an ordinary door-bell-ringing transformer can be used to supply the low voltage for the signal lamps. If 220 volts a.c. is employed, a similar transformer is available although it is slightly higher in cost. The illustrations show the wiring system for this and some of the other applications that will be described.

Circuit Supervision

A similar application is the supervision of certain power or light circuits in industrial plants. For example, a storage area or department that is not in active use may have a number of large lamps controlled by a single switch. An employee who has occasion to go into this area for a few minutes may leave without turning off the lights and it is quite possible that they will burn for hours, causing unnecessary waste.

Central supervision of such circuits can easily be provided by installing a bell-ringing transformer so that it will be energized when the lights are burning, and in turn light an indicating lamp.

Central supervision of doors or windows of all kinds can be obtained through the use of standard door-contact devices. Such a service, in most instances, can be arranged to indicate whether a door is open or closed, and whether it is locked. It can be invaluable for controlling doors in pattern storage rooms, stockrooms, die or mold storage rooms, engineering or office record vaults, private offices, railway or truck loading platforms, and so on.

Even Doors and Windows

With such a system, an executive or supervisor can tell at a glance which doors are closed and which are open, which are locked or unlocked. Also, it is possible to incorporate in the system retard devices, timed to hold off the making of the electric contact, when the door is opened only for the normal time required for a person to pass through it. It is possible to use a type of lock that will indicate only when the door is locked from the outside, preventing the false security that might ordinarily be felt just because a door is locked without considering that it might have been locked from the inside for ulterior motives. A local light signal can also be placed over the door, if desired, to show whether or not it is locked.

A type of application of a central supervisory system that will suggest many similar uses is that of supervising the level of sand in feeder bins, as used in certain foundries.

In one plant, for example, there

was a bank of about 30 sand bins which were fed from a rail car above, and it was found that some system was needed to tell the operator of the rail car which bin needed sand.

Special contactor devices were built to order, and one was placed in each bin. The bins are cone-shaped. When the sand drops to a certain level, a contact is made which lights a lamp and rings a bell at a central point in view of the car operator, thus notifying him which bin needs refilling. These signals are automatically reset to normal when the desired level is reached.

"In and Out" Systems

What is known as an "in and out" system has proved very valuable in many plants. The idea has been borrowed from the hospital, where such systems are in common use. It is an application of central supervision to executives, and is best adapted to plants that have an information clerk at the main entrance, or an attendant constantly on duty at a main gatehouse.

The purpose of the system is to keep the telephone operator informed at all times as to whether or not certain persons are on the premises. Such a system can save much time and trouble and make for improved telephone service between departments as well as for those who call from the outside.

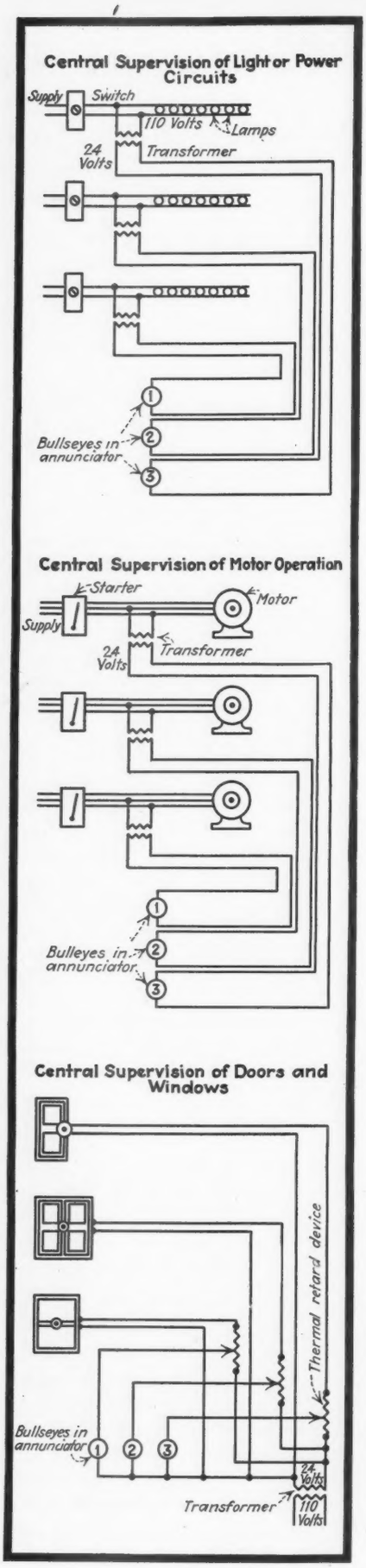
A lamp-type annunciator is placed at or near the telephone switchboard within the vision of the operator. This annunciator consists of a series of bullseyes, one for each person in the organization subject to call.

A toggle switch control cabinet is placed at the information desk or at the main gatehouse. When an executive leaves the plant during working hours the attendant flips the proper toggle switch, thus lighting the corresponding lamp in the annunciator.

The Operator Knows

When a call is received for an important person, the operator can tell by a glance at the annunciator whether he is in, and hence wastes no time trying to locate someone who is not on the premises. She can give a definite answer at once and promptly divert the call to an alternate channel.

This system can be installed at modest expense, the only equipment needed in addition to wiring materials being the bullseyes to build the annunciator and the toggle switches for the control cabinet. A common-return circuit is used; the low-voltage current is obtained from a transformer of suitable capacity.



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What Pittsburgh Does Others Can Do

TO REPAIR the ravages of five long years of depression and to get plants ready for better business in 1935, Pittsburgh industries will spend upwards of $35,000,000 during the next six months.

This amount includes only appropriations definitely announced, does not cover expenditures planned by a number of other concerns whose programs await complete operating reports for 1934. Nor does it include either the several millions of dollars that Heinz will spend in certain of its foreign plants or orders already on the books of such firms as Blaw-Knox, Mesta Machine, and United Engineering.

In many industries no action can be taken until new budgets are drafted, although the expenditures are being listed in tentative budgets.

They Will Spend

National Steel will expend $12,000,000 on long-contemplated construction at the Great Lakes plants. Carnegie Steel plans a new mill at Youngstown, to cost between $5,000,000 and $6,000,000. Also, as part of U. S. Steel's $400,000,000 improvement program, Carnegie expects $20,000,000 for three other mills.

Pennsylvania Bell Telephone has a program involving $2,000,000 for repairs and routine work in western Pennsylvania; American Steel Foundries expects to spend $1,000,000 to rehabilitate its Verona plant; two other concerns whose plans are still secret are hoping to get government loans of $1,500,000 for new equipment and other improvements.

Other expenditures ranging from $500 to $60,000 are planned by smaller Pittsburgh industries, including confectioners, coopers, chemical companies, pipe, business machine, and other producers.

Watch Grounding

Permanent electrical grounds must have low resistance, should be frequently checked, to safeguard men and equipment

C. W. TAYLOR
Chicago

MAINTENANCE of adequate ground connections seldom receives sufficient consideration in industrial electrical installations. Inspectors rely too much on visual checks, which are not made at close enough intervals. The consulting or designing engineer usually provides for a good ground system, but the main ground connections as well as the various joints in the tapped connections to equipment are too often and too soon forgotten.

Rules for grounding are included in the National Electrical Safety Code, but they apply particularly to small-capacity circuits and to low voltages. Heavier-duty circuits and higher voltages need the attention of qualified electrical engineers. The Code rules have their limitations, even in their intended field, and should be supplemented when necessary to meet special conditions.

In disregard of the rules, there is a noticeable tendency to leave off ground connections after making repairs, or replacing or adding equipment, particularly if there is no ground bus near.

A once-tight ground connection may become loose due to vibration or occasional movement, and show low resistance at one time, high resistance at another. Eventually the contact surfaces may oxidize, absorb paint or grease, or otherwise become dirty and of no value. This condition may develop even with sweated joints.

Permanent Joints

The best type of permanent joint is a brazed one. A fairly good substitute may be obtainable by sweating a bolted joint with tinned copper surfaces. Small wire may be injured or break. It is, therefore, sometimes advisable to use a much heavier conductor than would otherwise be necessary, even heavier than the individual line conductor, in order to provide sufficient ruggedness.

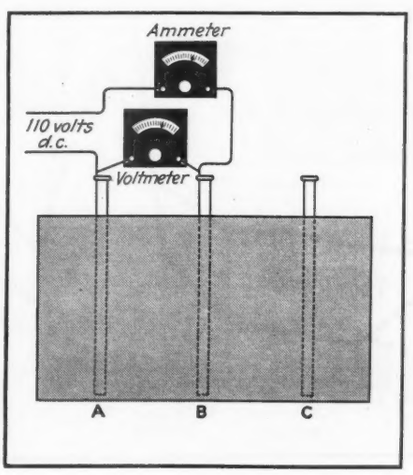
Joints should be located so as to facilitate, even invite, inspection. Solid conductors are preferable to bare stranded wire. Thin copper ribbon is sometimes preferable to round wire when bar is not justified. It affords some flexibility and will lie flat.

To Avoid Fault Grounding

Periodic checks should be made to insure good, solid ground connections and continuous circuits as well as low resistance to the earth. The main current-carrying conductor in equipment as well as the line leads should be tested periodically, if they are not continuously connected to a detector, to avoid fault grounding.

Hazards from fault grounds include fire, loss of equipment, and danger to life. Shocks from circuits carrying 110 volts or less have been fatal. Building steel, fencing, piping, metal rails, and other parts that may come in contact with current-carrying parts either directly or indirectly, as by conduction through moisture, dirt, or accidental movement, should be thoroughly grounded, as a general practice.

The earth connection should be given even more careful consideration. Five ohms is often specified as the maximum resistance permissible between grounded equipment and the earth. This value is high and should never even be approached on systems where large ground currents are possible.



At power stations where current capacity is large and voltage high the engineers will insist on a small fraction of an ohm resistance between ground bus and earth. Such installations also usually include many earth points with a ground bus arranged to form a grid or network.

In an industrial plant such an elaborate system is not justified if the circuits are comparatively few and of small capacity and low voltage. However, more than one earth point should usually be provided.

Earth Connections

The most common type of earth connection consists of galvanized iron pipe, 1 to 1½-inch diameter, driven to permanent moisture. Copper or copper-plated rod, plates, and cones are other familiar forms. Because of differences in local conditions it is difficult to make any rigid rule for selecting the type or number of earth connections. The sole object is to obtain a dependable, low-resistance ground.

A ground of low resistance may develop a very high resistance within a few weeks because of the type of soil, quality, or lack of water and so on. It may become necessary to treat the earth periodically with salt solutions, drive the pipe deeper, or even drill through the rock. For the best results several earth points connected together should not be less than 6 to 10 feet apart.

For making ground tests, 125-volt direct current is suitable. Alternating current is not always reliable; although the circuit may have practically no impedance, some part of it may be subject to external in-

fluences. When testing, overcurrent limitation or voltage regulation should be provided to control the flow of testing currents.

Resistance of instrument leads and connections between the earth connection and the points where measurements are taken, should be considered, although usually these points can be selected so that it may be neglected.

Portable ground-testing devices similar to insulation resistance meters are also available. They generate their own current and show the resistance directly in ohms.

A simple way of measuring ground resistance is shown in the accompanying diagram. Select any three earth connections. If only one is to be tested make two more, or one more if only two are available. Disconnect the three from each other and let A, B, and C represent their respective resistance. Then connect two together in series with the energy supply and the ammeter.

Measure the voltage drop between the two grounds and calculate the resistance by Ohm's law. This resistance is the sum of the two ground resistances. Repeat for all the grounds in pairs. These tests will give three simultaneous equations that can easily be solved. For example, assume that

$$A + B = 3 \text{ ohms}$$
$$B + C = 1.5 \text{ ohms}$$
$$C + A = 2.5 \text{ ohms}$$

Then

$$A = [(A + B) - (B + C) + (C + A)] \div 2$$
$$= (3 - 1.5 + 2.5) \div 2 = 2 \text{ ohms}$$
$$B = [(A + B) + (B + C) - (C + A)] \div 2$$
$$= (3 + 1.5 - 2.5) \div 2 = 1 \text{ ohm}$$
$$C = [(B + C) - (A + B) + (C + A)] \div 2$$
$$= (1.5 - 3 + 2.5) \div 2 = 0.5 \text{ ohm}$$

If all the grounds are connected, their total resistance may be found by the usual equation for resistances in parallel.

Light Up, Accidents Down

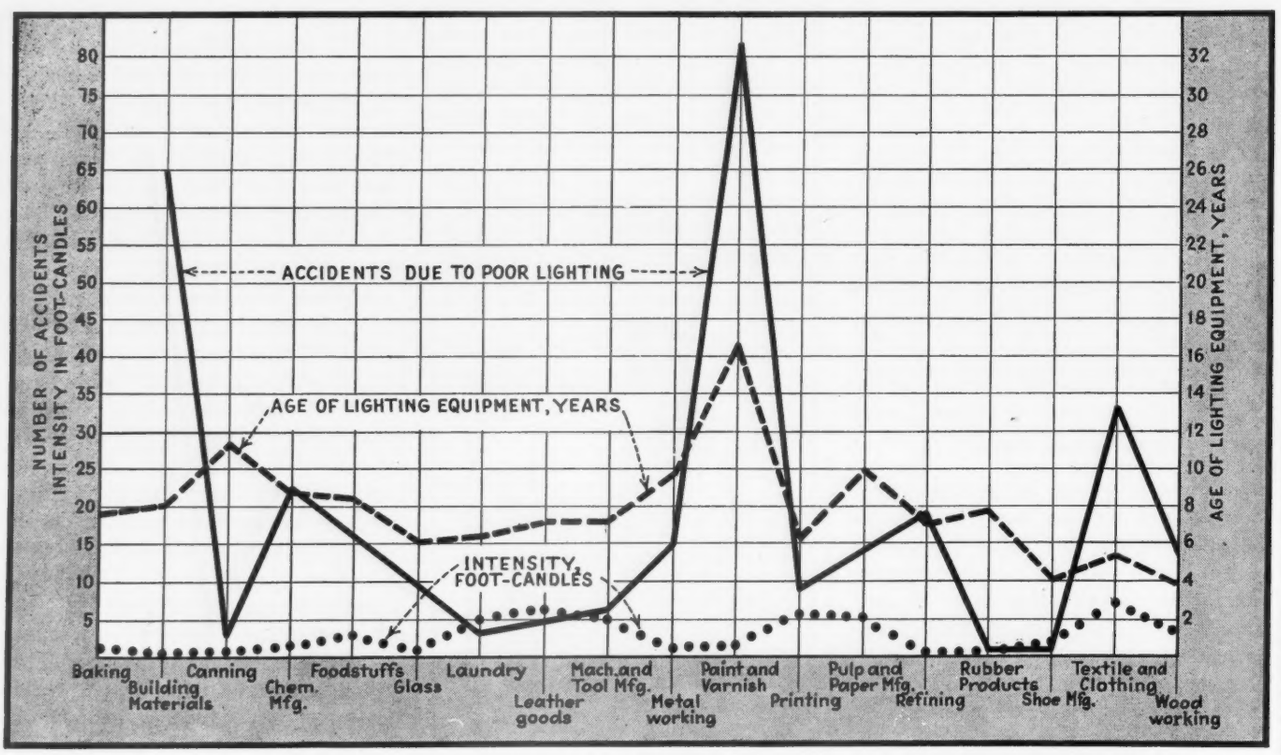
RELATIONSHIP between the age of lighting equipment, the intensity in foot-candles, and the number of accidents in eighteen industries is clearly shown in the chart. These data were obtained in a survey conducted by Charles D. Poey, Manager, Lighting Bureau, New York & Queens Electric Light & Power Company, and were presented at the Baltimore convention of the Illuminating Engineering Society.

Figures were furnished largely by lighting service engineers in 1,249 cities and towns in 36 states.

It will be seen that the number of accidents traceable to poor lighting are highest in the paint and varnish, building materials, and textile industries. Intensities in these industries average around 2 foot-candles for paint and varnish manufacture, 1 foot-candle for building materials, and 7 foot-candles for textiles and clothing. The average age of the lighting equipment in paint and varnish plants is somewhat over 16 years, in building materials mills it is 8 years, in textile and clothing plants it is about 5 years.

Kind and severity of accident hazards vary widely in the different industries. Some kinds of work require considerably higher intensities than others; quality of the lighting, judged by the presence or absence of glare, shadows, enters into the picture. Nevertheless, it will be seen from these curves that in most cases the number of accidents traceable to poor lighting goes up as the intensity in foot-candles goes down.

Also, the older the lighting equipment, the lower the intensity.



Lincoln Electric Company, Cleveland, adding to plant, takes some of its own medicine

In the interest of effective plant operation—the right equipment in the right buildings. Cost of new buildings, cost of upkeep on old buildings—both are involved. It is necessary to take advantage of technological development wherever possible

What Partitions?

Choice between the many types available depends on what you want and how much you want to pay

G. W. BORDEN
Construction Engineer, New York Dock Company
New York

INTERIOR partitions are used primarily to subdivide areas and must conform to the type of building in which they are installed, fireproof or non-fireproof. Selection of the type of partition to be used will depend on such factors as initial cost, durability, appearance, facility of installation during plant operation, and salvage value.

Fireproof partitions usually are built of brick, concrete, tile, compositions of asbestos or gypsum and other fireproof materials, and pressed steel. Brick partitions from 8 to 16 inches thick are the oldest type still in use. They are very effective and not too costly as a unit, but they require separate supports if placed above the ground floor, which is expensive and interferes with space on the floors below.

Concrete partitions may be designed to hang in main building columns (by means of dowels) or be supported over larger spans than brick, but the cost of installation due to reinforcing, forms, and form bracing frequently makes the cost extremely high.

Fire-proof Types

The most common types of fireproof partitions are hollow tile, composition blocks (which may be solid or hollow), composition planks and boards, metal lath and plaster on steel studs, and certain types of pressed metal and glass (usually for offices) within rooms inclosed by fireproof partitions or walls. Although these types of partitions are not so durable as brick or concrete, they will give ordinary life, seldom require supports from floors below, present a better surface appearance, and usually have a greater salvage value.

The accompanying table lists some of the most common types of fireproof partitions now used, with general information on a few of the important problems that commonly confront the prospective builder. The data given apply particularly to the New York area, where labor conditions and fire department requirements are slightly different than in other sections of the country.

Initial cost of installation of partitions will, of course, vary somewhat with the size of the job and the manner in which different combina-

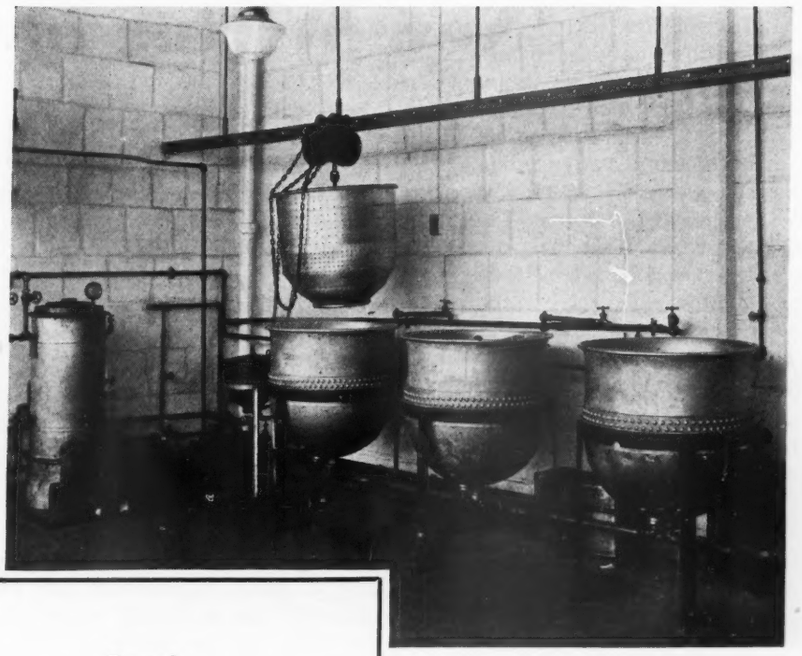
Industrial Plant Partitions

Type	*General Description*	*Approx. Cost per Sq.Ft.*	*Remarks*
Brick in 1:3 portland cement mortar	8 in. thick, max. height about 13 ft.	$0.65	Used for main, party, and bearing walls. Must have foundation on first floors and independent supports on upper floors unless building is designed to carry load. Appearance very rough unless brick is faced and joints sunken or beaded. Interior walls can be plastered; exterior walls should first be furred and lathed. Salvage possibly 25 per cent if care is used. Can be installed during factory operation, without much debris or noise. Requires little maintenance, is not easily damaged, long life if foundation is good.
	12 in. thick, max. height about 20 ft.	0.90	
	16 in. thick, max. height about 26 ft.	1.25	
Concrete mixes varying from 1:2:4 to 1:3:6. (Ave. 1:2½:5)	Interior walls usually 3 to 6 in. (Ave. 4 in.) thick	0.60 to 1.00	For main and party walls. Little bearing allowed. Short spans need little support up to about 15 ft. Will serve for usual 13- to 14 ft. ceiling heights. Appearance rough unless finished; add approximately 4 c. per sq.ft. per side for finish. Will not hold plaster well unless metal lath is used. No salvage; debris good only for fill. Requires forms, reinforcing, and form bracing to erect. Probable damage to property from water during erection. Durable and long lived.
		0.75	
Hollow tile in 1:3 portland cement mortar. (Scored or smooth)	3 in. thick height about 13 ft.	$0.22	For dividing walls only—no bearing. Seldom requires extra support in factory building. Not good for exterior walls. Appearance rough. Scored tile can be plastered without lath. Openings for doors, etc., should be framed with steel bucks. Salvage possibly 5 to 10 per cent if great care is used in removal; debris may be used for fill. Easily installed; little noise or dirt. Requires little curing.
	4 in. thick, height about 19 ft.	0.25	
	6 in. thick, height about 25 ft.	0.30	
Gypsum blocks, hollow or solid	.....	.....	Approximately same as for hollow tile except that cost is slightly higher. More soundproof and fire-resistant than clay tile.
Cement plaster finish ½-in. thick on blocks, plank, or composition board	For one side only	$0.07	Adds to appearance, cuts heat loss, strengthens wall, deadens sound. Use ordinary wood float finish in factory areas: steel trowel finish in offices with white finish coat. No salvage: removal results in debris only which makes poor fill. Can be put on as soon as partition wall is erected. Not easily damaged and is easily and quietly installed with little debris.

tions of the materials mentioned in the table are used.

A type of fireproof partition that can be reused at different locations is one of the many present-day problems in building maintenance. As noted in the table, salvage value is usually very small; hence moving of partitions is costly.

Framing for openings, mostly doors, is as important as the partition itself. The frames should be of structural or pressed steel which can be installed at the time of erecting the partition and must be anchored into it. Doors must be of sheet metal or three-ply wood, kalamein-covered, and can be sliding, swinging, or rolling types. They should be labeled to conform to Underwriters requirements and their installation must be approved.



Type	*General Description*	*Approx. Cost per Sq.Ft.*	*Remarks*
Portland cement or gypsum plaster on high-ribbed metal lath; plastered both sides.	About 3 in. thick without studs	$0.35	Used for dividing walls only—no bearing. Finish same as plaster on block partition. No salvage. Metal studs should be installed at openings from floor to ceiling to stiffen partition. Lath to be fastened at floor, ceiling, and columns.
.....	With metal studs on about 3-ft. centers. About 5 in. thick (½ in. cement plaster and metal lath on each side)	$0.30	Used for dividing walls only—no bearing. Stronger than lath and plaster alone. No salvage except studs. Finish and appearance same as above.
Composition boards of asbestos, gypsum, or plaster on metal studs	From 2 to 6 in. thick, according to air space desired between boards	$0.35 to 0.50	Used for offices, stock, and file rooms. Usually subdividing—no bearing. Appearance unfinished unless joints are covered with strips and panel effect made. Salvage is very small except with special type made for take-down purposes; then initial cost is higher. Should be used only inside of fireproof walls. Requires no independent support. Boards are usually ½ in. thick. Partition should not be less than 4 in. thick for ordinary factory heights if stiffness is required.
Plastered ½ in. thick, one side only	Adds ½ in. to thickness of partition	$0.07	Requires no lath and can be applied directly to the surface of main partition. No salvage. Finish either with wood float or steel trowel.
Hollow metal partitions	Built up of sheet steel with panels, ribs and glass. Usually 7 ft. above floor with filler to ceiling	$0.50 to 1.00	For offices, stock, and file rooms, subdividing areas, rest rooms, and dwarf partitions. Surface varies from bare metal to baked-on enamel. Salvage value usually 50 to 75 per cent. Can be used only inside of fireproof walls. Easy, quick, and clean to install during factory operation. Can be sound-insulated by filling panels with cork, asbestos, or other compositions. Different effects can be produced to suit requirements by the installation of glass panels between the chair rail and molding. The filler above molding can be glass, sheet metal, or wall board. Glass may be plate, florentine or syenite. Ventilators may be installed anywhere above chair rail.

Don't Forget the Sleeves

Another item not to be overlooked is pipe sleeves for piping that passes through partitions. These sleeves can be made of the next larger size of pipe or of sheet metal slightly larger than the exterior of the piping. The sleeve is made flush with both surfaces of the partition. Space between the piping and sleeve should be plugged with cement grout, plaster, steel wool or, preferably, asbestos.

Where masonry partitions are subject to damage from hand, rack, or lift trucks a structural steel member (usually a channel) should be placed on the flat and set horizontally into the partition at the time of erection. It should be located at the height above the floor where damage is most likely to occur.

If it is not practicable to protect the wall in this way, a continuous bumper of wood of the proper size may be placed on the floor and fastened to it or through the partitions at the intersection. The small amount of space thus lost is offset by the saving in cost of repairs.

Other types of partitions and the finishing of partition surfaces will be dealt with in a later article to appear in an early issue.

New Wiring for Old

Is not always as expensive as it sounds. A creamery did the job at low cost, probably saved serious trouble

K. B. HUMPHREY
Waterloo, Wis.

INDUSTRIAL electrical installations frequently "just grow" into conditions that for safe and efficient operation must eventually be corrected. Correction, however, usually waits until a failure of service or an accident has occurred, because plant operators sometimes do not see why, if motors keep on running, the wiring should be overhauled. Often, too, they have a strong suspicion that what starts out as a little job may end up as a big and expensive one.

Quickly, Neatly, Cheaply

Cluttered-up and obsolete electrical installations can often be revamped quickly, neatly, and at small cost. Improving a wiring job does not necessarily mean shutting down the plant, tearing out all the old installation, and putting in everything new; on the contrary, the work may be essentially rearrangement with a minimum of new material and equipment.

The illustrations represent an installation in a creamery that started out with three or four motors. Others were added, with connections made wherever they could be sandwiched in with the least trouble. As a result the large cabinet that contained the meter current transformers and branch fuses was crowded to capacity. Fuse blocks were located on the back, sides, behind the demand meter, and on top—wherever room could be found for them. Some of the connections in the box were made with weatherproof wire. Part of the circuits were dangerously overfused.

Ten circuits, serving twelve motors ranging from 2 to 20 horsepower ran out of the cabinet. The total connected load was 68½ horsepower, and a load of that size requires a safe wiring installation to minimize hazards and guard against interruptions, which in this case might cause an actual loss of material.

The simplest way of revamping this installation was to remove most of the fuse blocks that were jammed into the distribution box and substitute for them fused safety switches tapped off from a short bus extension. This procedure required only a small expenditure for new material, the principal costs being for labor and the safety switches.

The 400-amp., three-phase, 220-volt fused service switch was of ample size and was left in the same position, as were the distribution and meter cabinets.

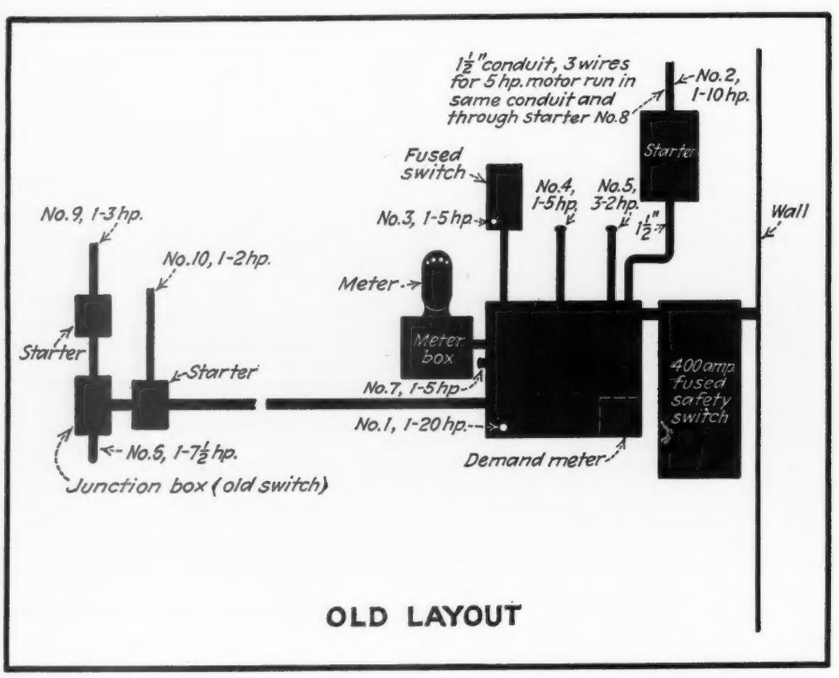
Circuit No. 1 supplied one 20-hp. motor. The conduit went straight through the wall from the back of the distribution cabinet. The branch fuse block was replaced with a 200-amp., fused safety switch, and the circuit carried in conduit back into the box and out through the wall.

One 10-hp. motor was carried on Circuit No. 2. The starter, which was located directly above the distribution cabinet, was left in place but the wires for Circuit No. 8 were removed from the conduit. The branch fuse block was removed from the distribution box, a 100-amp., fused safety switch was installed below the cabinet, and the circuit was carried back through the distribution cabinet to the conduit, as originally placed.

Circuit No. 3, supplying one 5-hp. motor, was left intact.

Conduit for Circuit No. 4, supplying one 5-hp. motor, came out on top of the distribution cabinet and went through the wall about 6 inches above the cabinet. The branch fuse block was replaced with a fused, 60-amp. safety switch, using a knockout in the back of the switch so that the conduit did not have to be moved.

There were three 2-hp. motors on Circuit No. 5, the conduit going through the wall about 6 inches



OLD LAYOUT

above the distribution cabinet. It was decided to remove the branch fuse block and install a 30-amp., fused safety switch, using a back knockout so that the original conduit need not be disturbed.

Replaced by Safety Switches

Circuit No. 6 supplied one 7½-hp. motor. The conduit carried the wires for Circuits 9 and 10, also. The branch fuse block was removed and the old conduit taken out to the point where it entered the wall.

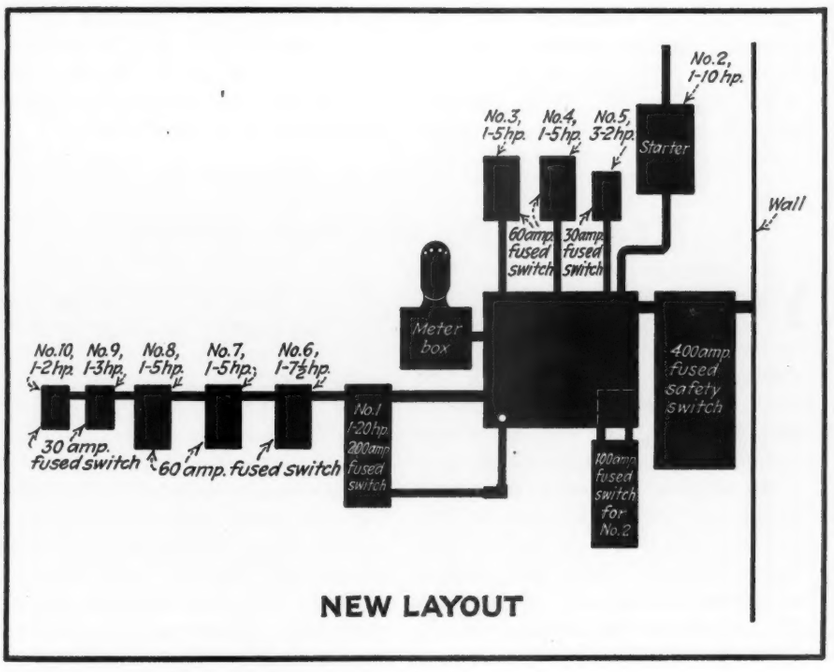
From Circuit No. 7 one 5-hp. motor was supplied, the conduit going through the brick wall about 2 inches to the side of the distribution cabinet. A 60-amp., fused safety switch was installed, and the conduit rearranged back of the wall and connected through the back of the safety switch.

One 5-hp. motor was fed from Circuit No. 8, the wires going through the same conduit as Circuit No. 2. The wires were removed and conduit installed from the point where the circuit left the old conduit to a new, 60-amp., fused safety switch. The branch fuse block was removed.

Supplying one 3-hp. motor, Circuit No. 9 was connected to the same circuit that supplied Circuits 6 and 10. The branch fuse block and old junction box were removed, a 30-amp., fused safety switch installed and connected to the bus, and conduit run from starter to switch.

Circuit No. 10 supplied one 2-hp. motor. The starter was mounted about 18 inches higher on the wall and in its place a 30-amp., fused safety switch was installed. New conduit was run from the switch to the starter. The branch fuse block was removed.

Other and perhaps neater layouts could have been made but they would have involved more conduit runs and cost considerably more without offering any worth-while advantages. With the new layout the operator can cut out any line in which trouble develops without interfering with the operation of the other circuits. Blowing one set of fuses cannot cause trouble on other circuits, as could easily have happened with the old layout. The new installation complies with the code and is efficient from an operating standpoint.



NEW LAYOUT

Lights in the Dark

D. W. ROBERTS

"CHIEF," said Mike Spazic, pressroom and forge shop motor inspector, "I noticed a funny thing once—right here in the pressroom. You know last winter when I was on nights I walked through this door just as the machines were starting up after midnight. The main fuses were blown on the lighting cabinet and the pressroom appeared almost dark. But down the aisle a ways I saw three dull red rings.

"When I came up to them I saw with my flashlight that it was the motors on those three big presses. I thought the rotor bars must be loose, and, with the motor running, the sparks from the bars to the end rings looked like a complete circle.

"After I had cleared up the lighting trouble, I went back to look those motors over. I shut the three presses down one at a time and gave the end rings the once-over. No bars were loose and the rings hadn't thrown solder, but they appeared to have been very hot. What was it?"

I explained to Mike that the rings must have been hot enough to glow dull red in the dark, that no solder was thrown onto the coil ends because the rings were soldered to the bars with silver solder.

Mike and I then went in and examined the insulation on the stator coil ends adjacent to those rotor end rings. There was no sign of the insulation having been overheated.

Apparently the rings became excessively hot only during the starting period and the radiation from the hot rings did not last long enough to overheat the adjacent stator coil.

The motors had then operated for almost ten years without rewinding, and have since operated nearly ten years more without winding trouble.

Single Circuits for Us

More flexible than a feeder system, less troublesome to operate, give better service to production, testifies

H. S. STEWART
Electrical Engineer, Crane Company, Chicago

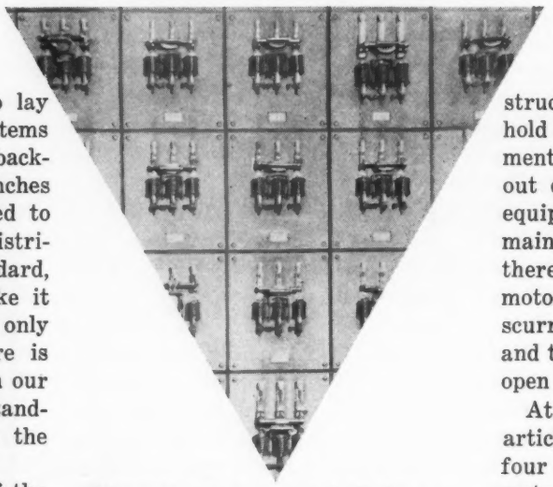
USUAL practice today is to lay out factory distribution systems in "tree" form—that is, with backbone feeders from which branches are taken off at points required to serve the load. This type of distribution has become almost standard, so much so, in fact, as to make it appear perhaps that it is the only way to do the job. But there is another way, greatly superior in our experience from an operating standpoint and easily defended on the score of installation cost.

Eighteen years ago, in one of the magazines that has since been absorbed by *Factory*, there appeared an article describing electrical construction in our plant and showing a type of layout that was the "last word" then, has since been greatly extended, and may conceivably be the "last word" tomorrow.

Instead of a group of feeders going out from the substation, each serving all motors in a given area, the motor circuits are carried all the way back to the substation switchboard where each is protected by a circuit breaker.

At first glance this system, which has been Crane practice since 1909, appears to be much more costly than the feeder idea. On examination the obvious arguments against it lose some of their force.

In the first place, the substations are so located about the plant that all of the circuit runs are short. None is more than 250 feet. There is no excess copper because each circuit is designed for its particular load. In a feeder system large main conductors must be installed as a purely elementary provision for load growth; often that excess capacity lies idle for long periods. In some cases it is never used at all. Our system uses no very large conduit nor heavy conductors, but requires only small pipe and light conductors which are more quickly and easily worked. The necessity for tap-off overload protections of fuses or circuit breakers is absent.



Motor circuits are carried all the way back to the substation switchboard where each is protected by a circuit breaker. When a motor is down, there is no scurrying round tracing out branches and taps to locate a blown fuse or an open breaker

But it is in operation that this individual circuit system shows its advantages. Trouble in motors or control affects only single circuits. There is no possibility for the destructive failure of one motor to hold up the work of a whole department by putting a group of motors out of business. Circuit protective equipment is all in one place, and the maintenance electrician goes directly there to restore service when a motor is down. He does not have to scurry around, tracing out branches and taps to locate a blown fuse or an open breaker.

At the time the above-mentioned article was published, there were four substations serving about 500 motor circuits in the Crane plant. In succeeding years the number of substations has grown to 16, the number of circuits to over 2,000. Included in the later growth are 2 substations from which distribution is in the conventional feeder pattern, and in another an addition of feeder distribution was made. Although detail cost records of installation are not available for comparison on this point, ordinary day-to-day experience with the two systems proves incontestably that the single-circuit installation is more flexible, less troublesome to operate, and gives better service to production.

Training for the Job Ahead

YOUNG men and girls coming directly from school to enter the employ of Richards and Sons (Folders) Ltd. first undergo a two weeks' training course in the school which is part of the company's new plant at Birmingham, England.

The purpose of the school is to develop the natural aptitude of the boys and girls and to insure that they will know their work before they enter the factory. Full wages are paid during the training period.

The experiment is being made not only for the benefit of the employees but also because the firm itself expects to benefit.

Each boy or girl is allowed to choose his or her own class of work. Boys may select woodworking, painting, wheelmaking, riveting, erecting, assembling; girls sewing, upholstering, or hoodmaking. The company makes baby carriages and wheel chairs, and employs about 500.

Those obviously unsuited for the jobs they choose are steered into more suitable work.

Questions *and* Answers

Conducted by G. A. VAN BRUNT

How Interpret These Tests?

A 10-hp., 220-volt, polyphase motor was sent in because anyone touching it while current was on received a severe shock. A 100-megohm insulation resistance meter gave a reading of 200,000 ohms. However, while standing on the wooden floor of our shop I touched the motor, with current on, and got a shock which experience would indicate was caused by a voltage of 60 to 75 volts. After this test a reading of 200,000 ohms was again obtained with the insulation resistance meter. The motor was baked for 8 hours at 212 degrees F., after which the insulation test showed infinity, but still I could not hold my hand on the motor. Eventually the motor had to be rewound. Can someone tell me why an insulation resistance measurement showed 200,000 ohms, while such a ground existed?

A similar question relates to a 1,500-watt, 32-volt lighting plant armature. An insulation test gave a reading of 75 megohms, but when a series test point was drawn across the commutator bars slight sparking was noticeable. After baking the armature for 7 hours an insulation test shows infinity, but tiny sparks are still visible under the series test. No reading is obtained with an a.c. milliameter in the circuit. Two other armatures of the same size and type give the same insulation resistance reading, but do not show sparks under the test light leads. Why? What should be done with the armature that sparks?

B.C.G.—Corpus Christi, Texas

INSULATION resistance of the motor was in reality much below the minimum value considered safe. The minimum ordinarily regarded as safe for small rotating machines is 1 megohm. Drying of the insulation by baking raised the insulation resistance to infinity, which is a good, but not necessarily definite, indication of a safe condition.

Another factor that often causes grounds which may not be detected by insulation resistance tests is the magnetic stresses set up when the machines are in operation. The windings are pulled against the slot walls and ends with tremendous pressure, and high leakage currents result where weak or thin spots in the insulation exist. I believe this explains why a shock was received when the motor was touched while running.

Results of the tests on the generator armatures are so contradictory and incomplete that no definite conclusions can be made. No reading of the ammeter in the series test would seem to indicate an open circuit, whereas sparking under the test lead points suggests the presence of current. It is necessary to have the commutator surface clean and smooth, or slight sparking under the test points is almost certain in this test.

I believe it is safe to assume that the high insulation resistance indicates no grounds and that the insulation is safe and dependable. It would be advisable, however, to subject these armatures to the regular bar-to-bar test.

J. L. YOUNG
St. Marys, Ohio

PROBABLY the results reported in this question can be traced to flow of current through the electrostatic capacity of the machines.

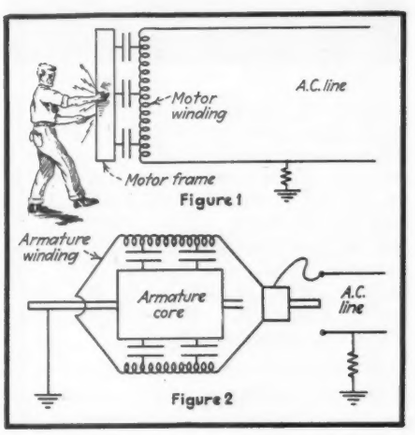
In an article published in the June 17, 1934, issue of *Electrical World*, Gordon Thompson, Assistant Chief Engineer, Electrical Testing Laboratories, shows that:

1. An electric shock may be felt if as little current as $\frac{1}{3}$ milliampere passes through the body.

2. The electrostatic capacity between a heater element and the surrounding metal sheath may become large enough to allow a charging current to flow in sufficient amount to cause a shock, although the ohmic value of the insulation is very high.

A generator or motor constitutes a similar condenser made up of the winding and the frame, with the insulation as the dielectric.

Under certain conditions of proper or improper grounding of the frame of



the machine, grounding of the operator and the grounds that practically always exist on any commercial circuit, the stage is set either for the operator to receive a shock when he touches the frame, or for sparking to appear as the test lead is moved around the commutator.

The current necessary to cause a shock or sparking under the test lead is so small as to give no readable deflection on a milliammeter having a range as low as 10 or 20 milliamperes.

Grounding the frame in Figure 1

(Continued on advertising page 60)

Answers Wanted

•

D.C. Generator Brushes Chatter

A 150-hp. d.c. generator is giving much trouble from constant chattering of the brushes. By putting a little paraffin on the commutator we can stop the noise for about an hour, but it always returns. The commutator has been turned down, but that did not help. Then the brush-holders were reversed so that the brushes point in the direction of rotation instead of against it, as formerly, but there was no improvement. Would the clearance distance between the brush-holders and the commutator affect the chattering in any way? How can I clear up this trouble?

C.E.—San Diego, Calif.

Wash or Paint?

A question has come up regarding the economy of washing walls and ceilings, instead of repainting. Our office and factory departments are painted a light cream color. The paint now looks dingy, although it appears to be in good condition otherwise, and something should be done to it. How do washing and painting compare in regard to cost and results?

K.C.G.—Newark, N. J.

From 220 to 440 Volts

I should like to know the best way to change a 20-hp., three-phase, 60-cycle, 220-volt squirrel-cage motor for operation on 440 volts, same number of phases, frequency, and speed. This motor has eight poles, 96 coils. Will this change affect the power factor or efficiency in any way?

E.D.—Chattanooga, Tenn.

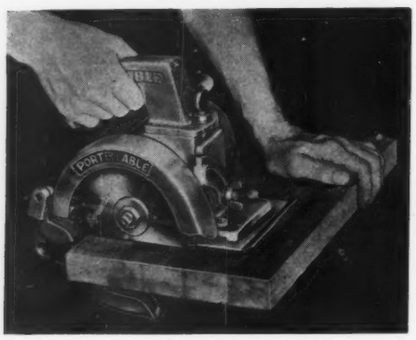
EQUIPMENT NEWS

Pump

Close-coupled, single-stage, end-suction, centrifugal. Capacities from 100 to 600 gal. per min. against heads up to 189 ft. For circulating and cooling systems, standpipe and water supply systems, transferring and handling reasonably clear industrial liquids. Pump and motor built together with single shaft. Inclosed-type impeller keyed to motor shaft which extends into pump casing. Only one moving part. Furnished with or without water seal. Available in semi-steel or bronze. Chicago Pump Co., 2346 Wolfram St., Chicago.

Saw

Portable, woodworking. Type K-66, Speedmatic. Has 6-in. blade with cutting capacity of 1⅞ in. Weight, 12 lb.



Finger tip depth and angle adjustment raises and lowers, tilts to 45 deg. Blade automatically guarded in every position. Universal motor develops ½ hp. at idle speed of 5,000 r.p.m. Cutting speed 4,000 r.p.m. Gear drive ball-bearing throughout. Dado cutters, abrasive disks, etc., may be used for cutting stone, marble, slate and composite materials. Porter-Cable Machine Co., Syracuse, N. Y.

Motor

Seal-Clad, induction, with protected winding. Bakelite shields, sealed over stator coils, protect against damage from metallic dust, grit, oil, moisture, mild acid. Ratings up to 25 hp., 18,000 r.p.m. Furnished with either ball or sleeve bearings. Allis-Chalmers Mfg. Co., Milwaukee.

Gages

Electric, contact, for indicating and controlling draft, pressure, and differential draft or pressure. Called "Draftrol." Combines indicating draft gage of pointer type with draft controller. Can be furnished with or without indicating pointer and with one or two non-tilting mercury switches for either high or low electric contact, or for both. The Hays Corp., Michigan City, Ind.

Welder

Alternating-current, motor-generator type. Takes 2- or 3-phase a.c. current of standard voltages and frequencies, converts it into a.c. current of lower voltage and higher frequency for arc welding with either heavily coated or washed electrodes in all positions. Built in portable and stationary a.c. motor-driven models in two sizes. Smaller capacity machine can be used for continuous welding with electrodes of $\frac{5}{32}$ in. to $\frac{7}{16}$ in.; larger handles electrodes from $\frac{1}{8}$ in. to $\frac{3}{8}$ in. Machines are wired for 220, 440, or 550 volts. a.c., 2 or 3 phase, 50 and 60 cycles. Called "Shield Arc AC." The Lincoln Electric Co., Cleveland.

Pump

Centrifugal, two-stage, "Monobloc." For services requiring small capacity and medium discharge head. Casing, designed to withstand 150-lb. pressure, bolted directly to motor frame without intermediate distance piece, eliminating base plate. Employs two inclosed-type impellers cast back-to-back. Motor has oversize grease-lubricated ball bearing. Impeller mounted directly on motor shaft. Unit can be mounted vertically or horizontally. Worthington Pump & Machinery Corp., Harrison, N. J.

Viscosity Indicator

For installation in fuel oil lines to register or control viscosity of fuel for efficient combustion. Called "Flo-Rator." Operates on rate-of-flow principle. Can be applied as automatic unit to control viscosity to any desired degree. Sterling Engine Co., 1270 Niagara St., Buffalo, N. Y.

Hose

Suction. Has woven tubular reinforcement of strong cable cotton cords and wire, claimed by manufacturer to result in strong but light hose which will not collapse. Lining is rubber. Manufacturer also claims hose can be restored to shape by vise or mallet if accidentally crushed, can be connected to standard couplings on the job, does not require soft ends on hose. Known as "Delmar Suction Hose." All sizes up to 4 in. inside diameter. Electric Hose and Rubber Co., Wilmington, Del.

Motor-Pump Unit

Built-together. Consists of centrifugal, side-suction pump with closed bronze impeller, mounted directly on shaft of ball-bearing splash-proof motor. Shaft runs in two ball bearings. Unit can be placed in any position and at any angle to fit application. Available in capacities from 10 to 250 gal. per min. And for heads up to 190 ft. with motors rated from ¾ hp. to 10 hp. Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago.

Caster Wheels

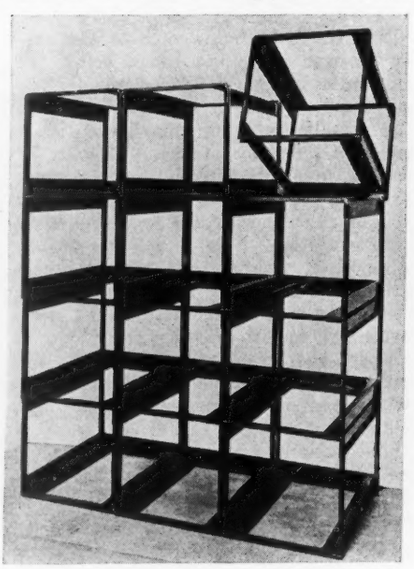
With vulcanized-on rubber tires. Two types: soft, recommended for irregular floors and comparatively light loads; semi-hard, recommended for smooth floors with extreme overloads. Bond Foundry & Machine Co., Manheim, Pa.

Drill

Ball-bearing, electric, with ⅜-in. capacity in steel. Addition to line of Skilsaw standards drills. Universal motor 60 cycles, all voltages, with armature statically and dynamically balanced. Field and armature windings baked in Bakelite and varnish. Drill housed in die-cast aluminum alloy body. Free speed, 500 r.p.m. Jacobs chuck. Bakelite-inclosed switch with snuff-arc construction. Motor cooled by fan mounted on armature shaft. Skilsaw, Inc., 3318 Elston Ave., Chicago.

Stacking Device

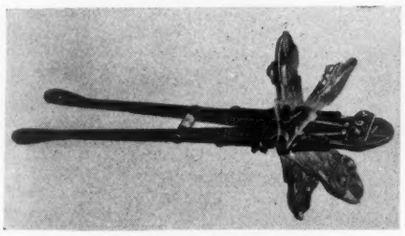
Made to order for stacking cardboard, fibre, wood, or steel boxes of any size. Called "Stackrack." Single-unit rack of welded channel and angle-steel construction. Enables stacking of boxes one on top of another, yet with bottom box as accessible as top. Finished in baked-on olive-green enamel. Stackbin Corp., Providence.



Potentiometer

Portable. Designed to enable pyrometer users to check potentiometers, millivoltmeters, and thermocouples quickly and accurately. Combination of step-switch and slide wire makes possible reading indicating scale to 0.01 millivolts over total range of 71 millivolts. Indicating scale is 17 in. long, smallest scale division over 1/16 in. wide. Fully inclosed suspension-type galvanometer with approximately two-second period. Size: 9⅜ in. wide, 10¼ in. deep, 6¾ in high. Weight, 12¾ lb. Brown Instrument Co., Philadelphia.

Bolt Clipper



Swivel head. Called H.K.P. Swivel Head Cutter. Head swivels to any angle on either side of handles. Shoe will hold any standard head of given size: clipper cut, center cut, chain cutter, nut splitter. Kit also available for changing standard Porter tools into Universal swivel type. H. K. Porter, Inc., Everett, Mass.

Table

All-steel. Known as No. 680. With exception of drawer, fabricated entirely of 16-gage metal. Tapered legs. Size, 42x26x30 in. high. Smooth top. Braced underneath. Drawer, 26x22x3½ in. high. Olive green finish. Can be shipped either knocked down or set up. May also be had without drawer. Bottom shelf furnished, if desired. Angle Steel Stool Co., Plainwell, Mich.

Twine

Called "Pacord." Kraft paper covers Manila center and is tucked among fibres to prevent slipping back or unwinding when cut. Claimed to have more yardage and strength than either hard or soft fibre twine, be economical to use. Suitable for shipping room of industrial or manufacturing plant for all tying requirements. Packed in coils, reels, bales, or 5-lb. cartons. Tubbs Cordage Co., 200 Bush St., San Francisco.

Tractor

Redesign of Model 35. Numerous improvements aimed to provide greater riding comfort, greater steering ease, smoother operation, longer life. Can be powered for either diesel, oil, or gasoline, and has drawbar pull of slightly over 43 hp. Bates Manufacturing Co., Joliet, Ill.

Compressor

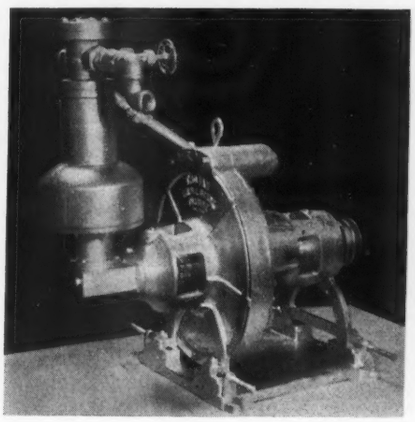
Single-stage, straight-line, double-acting. Timken roller bearings. Known as Class 3-AT. For air or gas. Available in sizes from 5 to 125 hp., and for pressures from 12 to 150 lb. Equipped with air-cushion valves. Pennsylvania Pump & Compressor Co., Easton, Pa.

Switches

Weatherproof, dust-tight, Type A Safety. In standard sizes from 30 to 600 amp. capacity. Main switch mechanism as in standard EC&M Type A switches. Fully interlocked door prevents operating switch with door open or opening door with switch closed. Inclosed in rust-proof steel cabinet, enameled. Rubber gaskets between door and cabinet. The Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland.

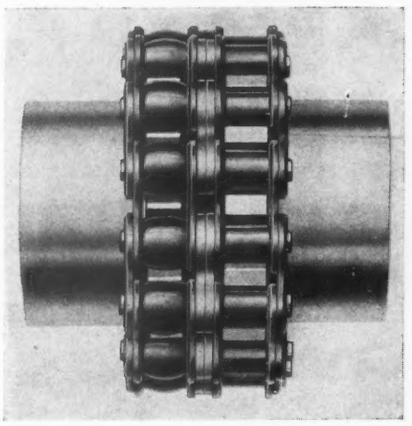
Turbine

Auxiliary, steam. For use in connection with generators, providing a power unit for services requiring up to 3½ hp. Known as "Trojan Turbine." Governor does not come into direct contact with steam. All bearings designed for high-speed operation. One-piece rotor, according to manufacturer, will withstand all abuses to which it might be subjected, such as wet steam, variable pressures, and lack of regular attention. Machine built complete with base plate, on which can be direct-connected generator or pump of any standard design. Weight, complete, approximately 275 lb. California Bettis Co., 1900 E. 65th St., Los Angeles.



Coupling

Flexible, chain. Designed to provide for free operation without friction and excessive noise. Has double-width roller chain. One strand of chain has standard cylindrical rollers, other



strand convex surface oversize rollers to provide for free operation where shaft deflection and misalignment exist. Claimed to handle shaft deflections up to 3 deg. without undue strain. Self-aligning, does not require oil-tight case or housing. Baldwin-Duckworth Chain Corp., Springfield, Mass.

Hydraulic Cylinders

Double-acting, for high-pressure service. Numerous types, sizes. Practically any required length of stroke. Standard models designed for working pressures up to 1,500 lb. per sq.in.; special cylinders furnished for higher pressures. No tie rod. Cylinder caps removable without disturbing mounting. End caps can be turned so that inlet port is located at top, bottom, or either side, can be positioned independently of each other. Cylinders available with small-diameter piston rod or with two-to-one differential of piston area. Hannifin Mfg. Co., 621 South Kolmar Ave., Chicago.

Switch

Small, track-type, spring-return, limit. For making or breaking control or indicating circuits at fixed point in travel of part of machine or mechanism. Designated as CR9440-A1A. Has one normally opened, one normally closed circuit. Maximum carrying and breaking capacity is 5 amp. at 550 volts a.c., on d.c. ranges upward from 0.4 amp. at 550 volts to 2.0 amp. at 115 volts. Mechanism operates on worm-and-gear arrangement in which threads on bolt that

clamps arm to shaft engage with threads on latter. Double-break, silver-plated contacts. Switch, with exception of operating arm, is inclosed in die-cast box 4 in. high, 2 7/16-in. wide, 1-29/32 in. deep. General Electric Co., Schenectady, N. Y.

Elevator Control Shift

Power-driven, controlled by remote, constant-pressure, "up" and "down" buttons, and used to shift the shipper rope on a cable-controlled elevator.

Known as "Electro-Shift." Can be located at any point having convenient access to shipper rope. Drive supplied by reversible motor through reduction gears which provides slow speed at each travel limit and at middle or neutral point. Equipment supplied for any current, and for hydraulic or electric elevators. Landing gates or doors can be interlocked with control circuit of unit or through separate circuits. Quincy Elevator Gate Co., Wahl St., Tiffin, Ohio.

Rheostat

For all electroplating processes. Claimed by maker to give close current regulation. Switches are self-cleaning, constant-pressure, cam-type. Resistors are of helical, coiled michrome wire. All contacts have surfaces protected by Udylite Cadmium coating. The Udylite Co., Detroit.

Condensation Units

Centrifugal, motor-driven. For handling condensate at 210 deg. F. Called "Redi-Return." Consist of steel receiver with float switch, water gage, high and low inlet openings, vent and drain openings, and bronze-fitted pumps. Both single and twin units. American Steam Pump Co., Battle Creek, Mich.

Photo Relay and Light Source

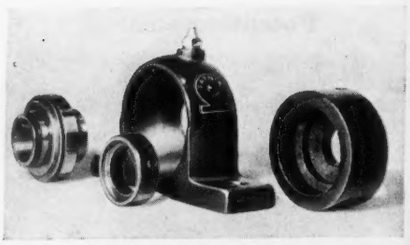
Completely equipped with photocell, amplifier, and light bulb. Known as Model "A." Full-sized, commercial type equipment. Relay measures 4x4x5 in., light source 2x2x4 in. Relay is universal a.c., d.c.; light source available for operation on 110-volt, 25- and 60-cycle current. Claimed to operate with full efficiency 400 times per minute. Electronic Products Co., St. Charles, Ill.

Transformer

Air-cooled, lighting. Inclosed in case with separate compartment for primary and secondary leads. Knock-out holes for entrance of flexible or rigid conduit. Used to supply 110-120-volt current to lamps and small motor-driven tools and heating appliances. Capacities up to 20,000 volt-amp. Jefferson Electric Co., Bellwood, Ill.

Pillow Block

Cork insulated, ball-bearing. Bearing is wide inner-ring type with Fafnir self-locking collar. Block has deep-groove, large-ball design. Claimed to



afford high load capacity, thrust as well as radial. Housing is cast iron with ribbed base. Pre-lubricated at time of assembly. Cork pad insulation fits into housing and around bearing to insure silent operation, act also as seal against escape of lubricant, entrance of dirt. Fafnir Bearing Co., New Britain, Conn.

Heater

Single-pipe, built-in. Known as "Simplex Convectofin." Operates on uniflow principle, with series-parallel circulation, venting, and pressure loss compensation. Manufacturer claims to have overcome disadvantages of usual one-pipe installation. Commodore Heater Corp., 11 West 42d St., New York.

TRADE LITERATURE

AIR CONDITIONING—Bulletin No. 204, on Peerless exhaust fans, and Bulletin No. 203, on Peerless air conditioning equipment and controls.—The Peerless Electric Co., Warren, Ohio.

CEMENT — Bulletin, "Heavy-Duty Floors with 'Incor' 24-hour Cement."—International Cement Corp., 342 Madison Ave., New York.

INSTRUMENTS—Circular No. 314-I, on system of numerals in colors for multiple-point instrument records.—Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia.

GAGES — Bulletin No. 2018, on Draftrol electric contact gages for indicating and controlling draft, pressure, and differential draft or pressure.—The Hays Corp., P. O. Box 299, Michigan City, Ind.

HUMIDITY CONTROL—Bulletin No. 1, on the Calorider system of humidity control. — Research Corp., Calorider Div., Chrysler Bldg., New York.

LACQUER—Booklet "How Good Are You at Twisting and Bending?" Describes, illustrates by samples, flexibility of Flexible Blue Knight Blax (lacquer).—Roxalin Flexible Lacquer Co., 800 Magnolia Ave., Elizabeth, N. J.

METER—Bulletin, "Fuel Oil Combustion Efficiency with the Flo-Rator," (viscosity meter).—Sterling Engine Co., 1270 Niagara St., Buffalo, N. Y.

METERS, INSTRUMENTS — Booklet, "Solving Industrial Crimes, Case No. 5." The Esterline-Angus Co., Indianapolis.

MIXER — Bulletin, describes "Typhoon" portable power mixer and Patterson "Unipower" agitators. — The Patterson Foundry & Machine Co., East Liverpool, Ohio.

MOTOR—Leaflet 2182, describes new Seal-Clad induction motor with protected windings.—Allis-Chalmers Mfg. Co., Milwaukee.

MOTORS—Bulletin No. 214-A, "Ohio Motors for Air Conditioned Heating Systems."—The Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland.

MOTOR MAINTENANCE — Booklet, 64 pages, "The Brush Phase of Motor Maintenance."—The Ohio Carbon Co., 12508 Berea Road, Lakewood, Ohio.

PIPE, TUBING—Bulletin on design and fabrication of expansion loops made up with Tube-Turns and straight lengths of pipe and tubing. Chart for determining loop dimensions.—Tube-Turns, Inc., 425 Fifth St., Louisville.

PUMPS — Bulletin No. 108, illustrations, mechanical descriptions, engineering data on line of compact, close-coupled, centrifugal pumps.—Chicago Pump Co., 2346 Wolfram St., Chicago.

PUMPS—Two bulletins, on single-

(Continued on advertising page 66)

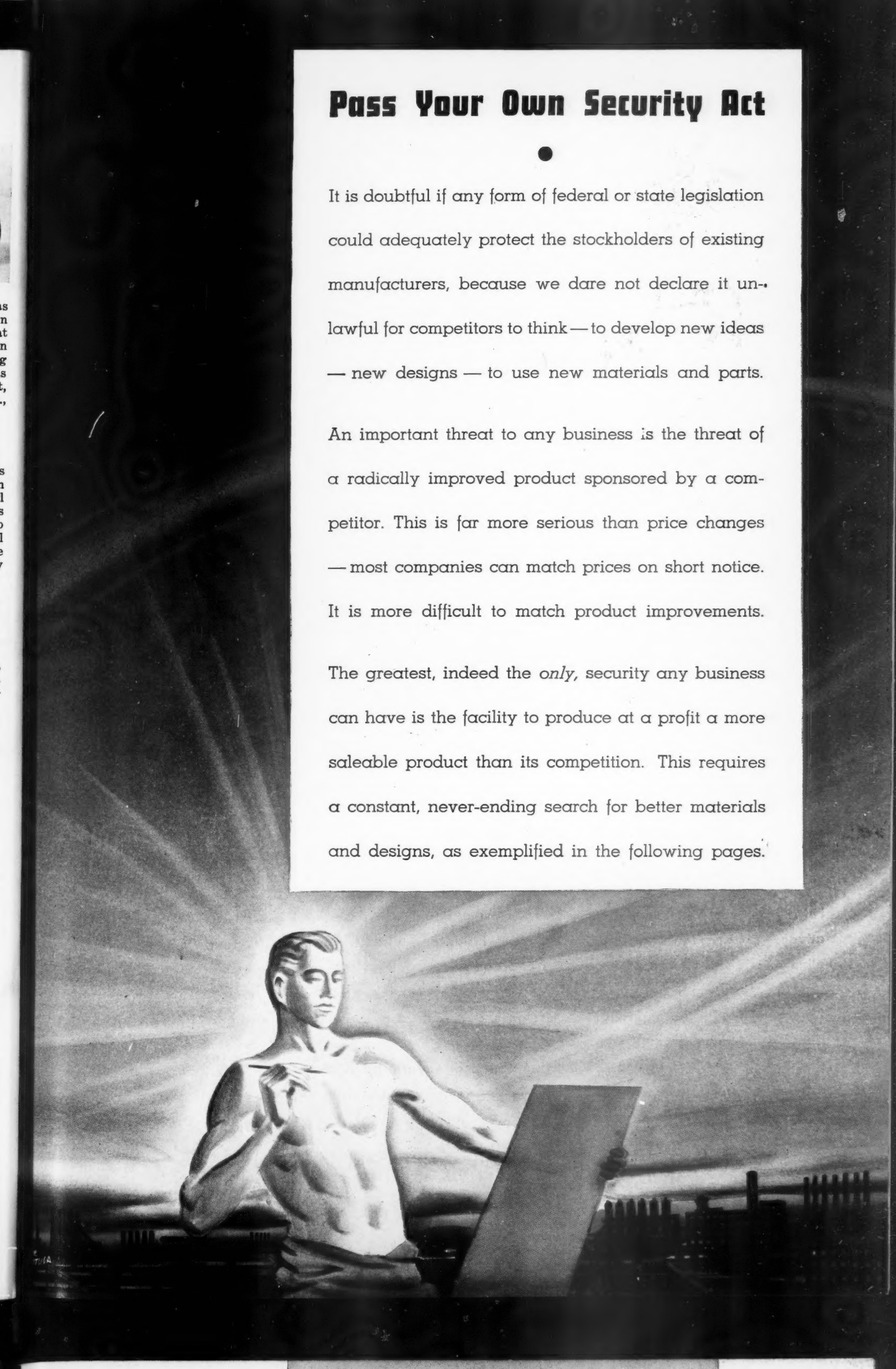
Pass Your Own Security Act

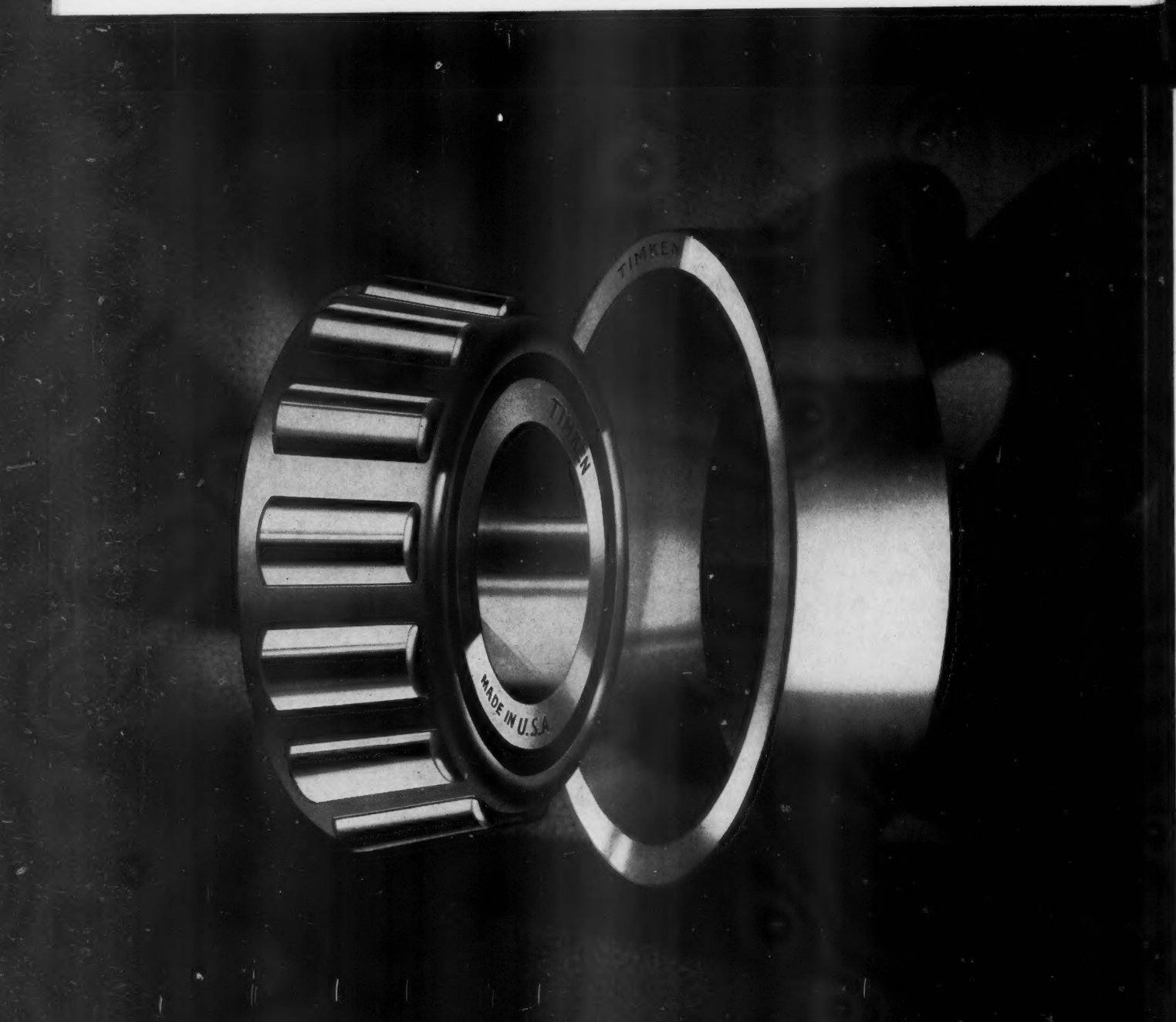
●

It is doubtful if any form of federal or state legislation could adequately protect the stockholders of existing manufacturers, because we dare not declare it unlawful for competitors to think — to develop new ideas — new designs — to use new materials and parts.

An important threat to any business is the threat of a radically improved product sponsored by a competitor. This is far more serious than price changes — most companies can match prices on short notice. It is more difficult to match product improvements.

The greatest, indeed the *only,* security any business can have is the facility to produce at a profit a more saleable product than its competition. This requires a constant, never-ending search for better materials and designs, as exemplified in the following pages.





"TIMKEN" answers every Bearing question

Put Timken Tapered Roller Bearings in your equipment and you get even more than the unrivalled mechanical advantages arising from the exclusive combination of Timken tapered construction, Timken positively aligned rolls and Timken alloy steel. In addition you get one of the most important sales advantages that any equipment manufacturer can have. For Timken Bearings have become so well and favorably known, both through performance and a third of a century of national advertising, that buyers of industrial equipment *everywhere* give preference to products that are Timken-equipped. That gives you a double-barrelled benefit . . . mechanical superiority AND sales superiority . . . a fitting and conclusive answer to the bearing question when modernizing any type of machinery.

TIMKEN BEARING EQUIPPED

THE TIMKEN ROLLER BEARING COMPANY ◆ CANTON, OHIO

TIMKEN *TAPERED ROLLER* BEARINGS

Copyright 1935 by The Timken Roller Bearing Company

RUBBER
for silence .. and silence for SALES

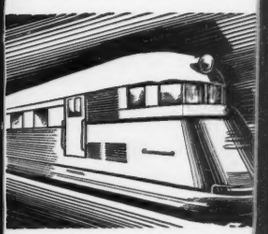
Noise-maddened, the world rewards with sales the product which brings silence and welcome relief.

Rubber has always quieted noise, absorbed noise-making vibration—but rubber did not adhere, it oxidized, had many other vital defects. Then Goodrich application engineers developed the science of *rubber compounds.* Now rubber, retaining all and more of its silencing ability, can also be made to last and flex indefinitely, adhere to metal, resist chemicals, air, oil, and can assume almost any form, texture, color.

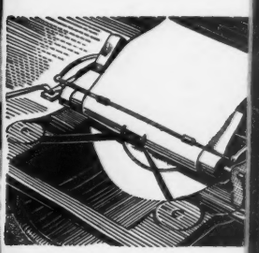
Here is a *new material,* developed by Goodrich, ready to bring sales-making silence to your product—or your competitor's. Who will act first?

The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

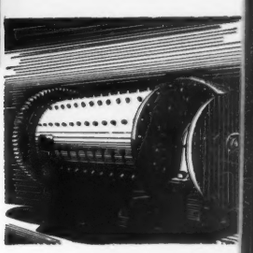
Noisy metal wheels on a toy automobile were changed to silent rubber. Grateful parents doubled the maker's sales.



Rubber virtually makes the modern rail car (and many another product) possible. It absorbs the terrific vibration caused by speed, and provides silence and comfort both.



Offices would be unpleasant places, typewriter sales would be less, if it were not for noise-deadening typewriter platens, of Goodrich rubber.

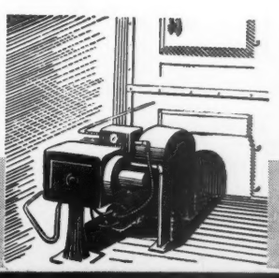


Experts know that noise cuts workers' efficiency. Rubber linings for ball mills reduce noise, while also reducing production cost.

Goodrich

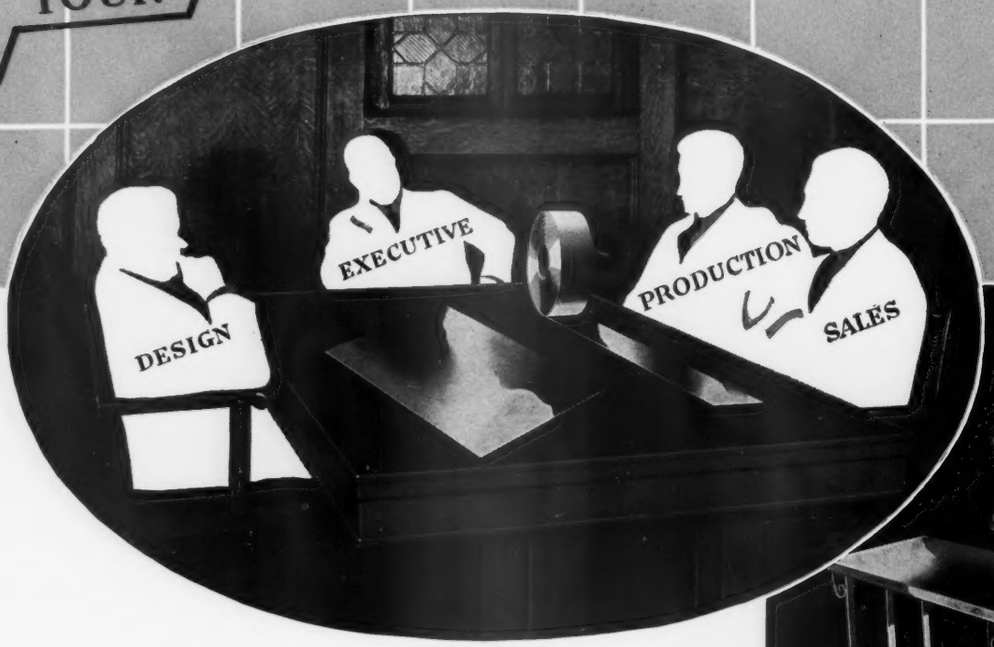
ALL *products problems* IN RUBBER

Noise retarded oil burner sales. Rubber motor mountings changed noise into silence. Sales soared.

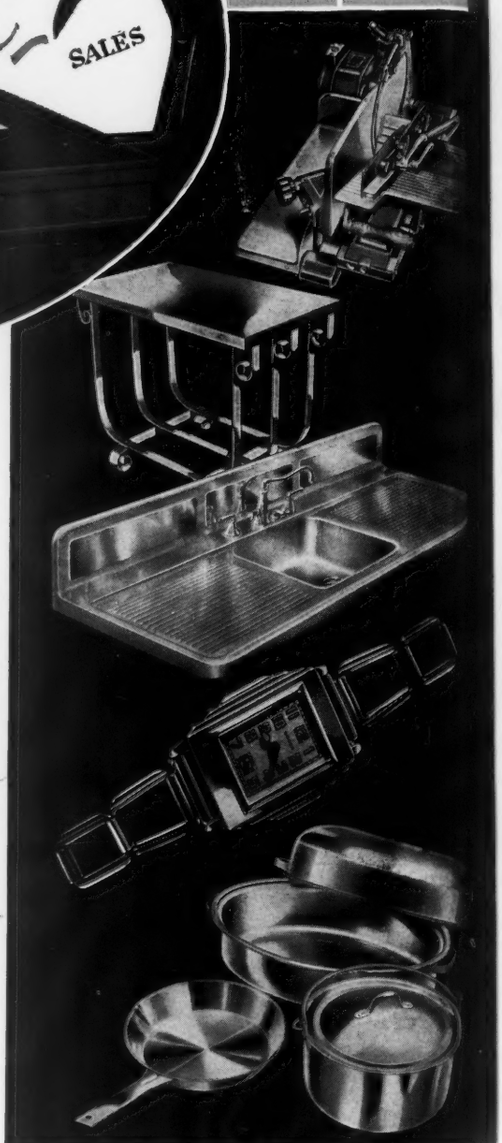


At fifty-six different points, one well-known modern automobile uses rubber for silence—and silence for sales.

WHEN YOUR SALES CHART LEVELS OFF . . . .



It's time for ENDURO *to sit in*



Many manufacturers have found through experience that ENDURO can inject new life into the sales of established products and insure a warm public welcome for new ones.

ENDURO looks like silver, but wears like steel—because it is Republic's Perfected Stainless Steel. Its never-changing beauty and many finishes permit the designer wide latitude for the exercise of his skill. Its workability, uniformity, and the many forms in which it is available allow it to fit easily into production schedules and to be fabricated with present equipment. And there's enough of the unusual about products made of ENDURO to whip the imagination of your sales force to the point of actual enthusiasm. The results are—more sales, easier competition for the ultimate buyer's dollar and increased profits.

Look ahead. Let ENDURO sit in on your next planning conference. It makes no difference what you manufacture—if better appearance, greater strength, improved corrosion- or heat-resistance, or longer life will help you make more sales, then ENDURO is meant for you. What other users have learned about ENDURO can be turned to your advantage in the designing, making and selling of your own products.

Write for detailed information.

Licensed under Chemical Foundation Patents Nos. 1316817 and 1339378.

CENTRAL ALLOY DIVISION . . MASSILLON, OHIO

REPUBLIC STEEL CORPORATION

GENERAL OFFICES YOUNGSTOWN, OHIO

ENDURO

REPUBLIC'S PERFECTED STAINLESS AND HEAT-RESISTING STEELS

POWER TRANSMISSION NEWS

Morse 1935 calendars are now being distributed. If you haven't received your copy, write us and we will be glad to send you one of these interesting pictorial calendars.

Superior Lubrication

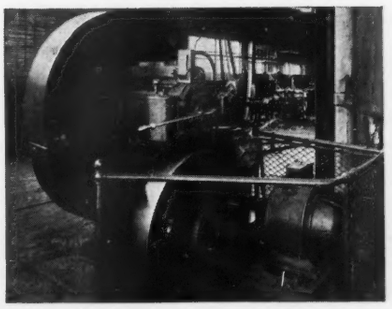
The fact that Morse Roller Chains last longer is due not only to superior alloy steels used, but also to the Morse exclusive design which provides for thorough lubrication inside and out.

Note in the above illustration how completely every wearing surface is lubricated. There is ample capacity, as you can see, inside every joint to assure this one hundred per cent lubrication which in turn insures smooth, trouble free performance which makes Morse Chains doubly popular.

Large Morse Drive

One of the largest diameter silent chain sprocket wheels ever made, measuring 131 inches in diameter. Casting weighed over 10 tons.

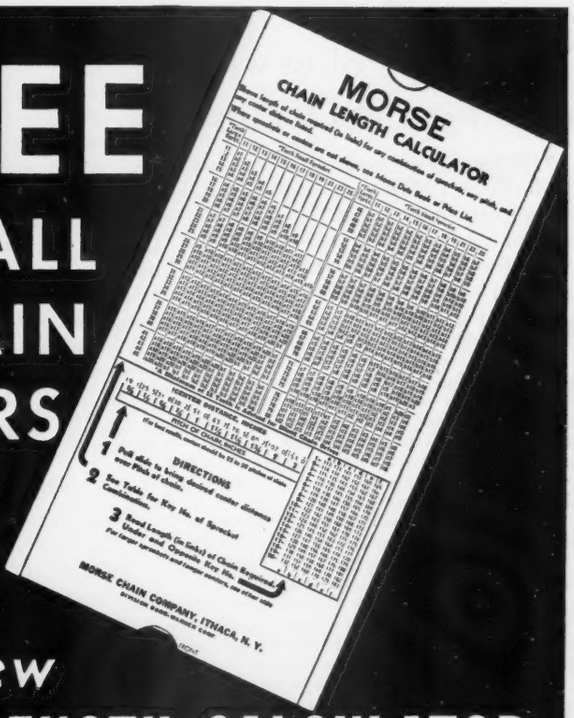
Driving rolls in a steel mill, this enormous drive replaces gears in a change over to motor drives from steam. This Morse Chain Drive transmits 1000 H. P. at 45 R. P. M.



In Use Since 1902

Since 1902, this bar stock shear has been in daily service. Here's what the shop superintendent says: "The machine was installed in 1902 and is used daily for shearing bar stock up to its capacity. The machine was purchased with the Morse Chain drive and has been giving excellent service since its installation. The chain is going strong and it is believed that it will last until it has reached the age of 40 years."

FREE TO ALL CHAIN USERS



This new CHAIN LENGTH CALCULATOR

FOR EITHER SILENT OR ROLLER CHAINS

Correct chain lengths at a glance. Here's a new and helpful calculator. Shows length of chain required for any combination of sprockets, any pitch, and any center distance listed.

You can have one of these Morse Chain Calculators by writing us on your business letterhead.

MORSE CHAIN COMPANY

DIVISION OF BORG - WARNER CORPORATION

103 TURNER PLACE • ITHACA, NEW YORK

ADVERTISEMENT—*Each item on this page is a paid advertisement*

Don't Play Poker with Your Fire Protection

THERE is enough risk in any business today without gambling on fire protection. So if you have oil, gasoline or lacquer hazards in your plant, try this simple test to make sure you are getting the protection you ought to have.

Puncture six or eight nail holes in the bottom of a pail and hang it about three feet off the ground. Half fill the pail with gasoline and set fire to it. Then try to put out the fire in the running gasoline with your fire extinguishers. If they fail, how do you expect to put out a fire involving flammable liquid pouring from a leaking pipe, a spilled container or an overflowing tank?

You can get the most complete protection possible against flammable liquid fires with LUX extinguishers. They not only put out flammable liquid fires burning on a surface as effectively as foam or carbon tetrachloride, but they also snuff out running oil or gasoline fires against which other types of extinguishers usually fail.

Don't gamble with half-way fire protection. Write for complete information on LUX. Walter Kidde & Company, Inc., 72 West Street, Bloomfield, New Jersey.

2 Reasons Why You Play Safe with LUX

The new Super-LUX extinguisher has greater fire extinguishing *power* than similar extinguishers of equal size because it contains 33% more extinguishing agent.

The Super-LUX extinguisher has greater fire extinguishing *punch* because it discharges gas at a faster rate, longer range and greater volume.

For All Electrical and Flammable Liquid Fires

It's "Hour Rates" in Detroit

(Continued from editorial page 10)

men so often," was the way he explained it. The principal stoppages had been due to lack of coordination between operations, material shortages, and machine and conveyor breakdowns. The men lost under the old system; the factory loses now, or rather sees to it that it does not lose.

As another high official put it:

"There is no so-called incentive plan that will make a man work unless he is provided with work uniformly. When that is done, no incentive plan is necessary."

In another plant the belief is expressed that the average good workman wants to produce a good day's work for a good day's pay; to win the respect of his foreman and his fellow workers; to be fair and honest; to receive proper credit for work well done. Some of the incentives suggested are pride in workmanship, desire to excel, desire for recognition, credit for accomplishments, and above all the desire to give full and satisfactory work in order to hold a well-paying job.

Conveyor Sets Pace

One of the questions propounded in the early part of this article implied that perhaps a wage incentive was not necessary because the conveyor set the pace. To one who has observed a modern assembly line in operation this seems to be a satisfactory explanation. Unfortunately, however, there are a multitude of operations, particularly in the machine shop, that are not conveyorized and where such a broad statement does not hold true.

In the past, payment of time wages proved unsatisfactory from management's viewpoint largely because no comparative individual records were kept, and all workers in the same class received the same wage.

With working conditions standardized, however, with a plan of production control in effect, and with the best method and a standard time a matter of record, the straight hourly wage takes on a new aspect. Each workman knows what is expected of him. Records of individual output are kept. The management has a definite basis for wage increases and promotions. Such rewards for meritorious work stimulate other workmen and have a beneficial effect on shop morale.

In other words, such a system becomes as much a wage incentive for extra effort as any yet devised. This is in my opinion the most significant aspect of the whole change.

One of the chief incentives now offered lies in the attainment of a classification or rank. Obviously, in order to maintain or increase employee satisfaction, which is the major objective, it is necessary to set hourly rates so that the worker earns approximately the same as he did before for the same output.

A Typical Rate Structure

There are usually about three flat hourly rates for a particular job corresponding to base rates under the bonus system. A typical rate structure for drill press operators, for example, would be as follows:

	Base Rate Bonus Plan	*150% Bonus at 115% Task*	*Flat Hourly Rate*
Beginner	$0.50	$0.75	$0.70
Production	0.52	0.78	0.75
Top	0.54	0.81	0.85

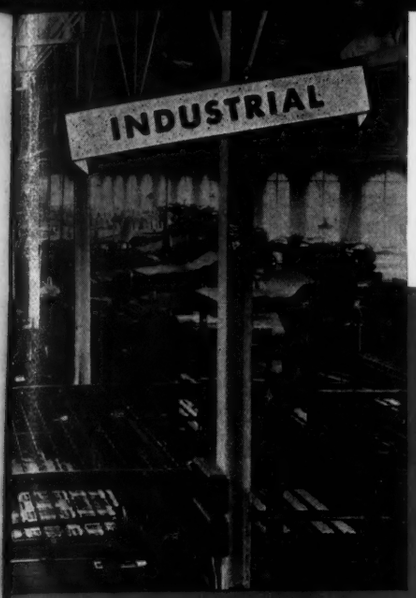
Detroit still leads in comparative wage rates. This group represents a fairly wide spread in wages and provides an incentive to reach the top scale. Besides, there are classifications set up at the behest of the Automobile Labor Board that provide even greater incentives.

These classifications refer to preferential lists during lay-offs and in rehiring. To be classified as a (d) man means that a worker is essential to the operation of the plant or has exceptional ability. Such a man usually survives all lay-offs. A (c) man (married) and a (b) man (single) have seniority rights in terms of years of service so that the incentive does not apply here, but to attain a (d) status provides a tremendous incentive for job security to the lower groups.

The (d) man is an all-around mechanic who can handle almost any job in the department. Under a straight hourly rate plan, foremen are encouraged to rotate their good men without the usual kick from the men that they lose money on a new and unfamiliar job.

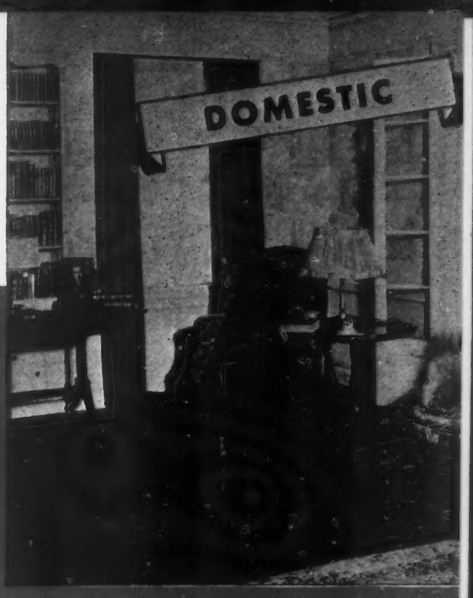
Conversely, there is a negative incentive in the threat of dismissal for lack of efficiency. A dismissal is a very serious action in these times. Much greater responsibility is placed upon the foreman than before, not alone because he must be able to substantiate his action against claims of discrimination, but because he must really *know* what his men are accomplishing.

He must be constantly informed as to the rate of production of each employee and see that the hourly rate paid is justified. He must study



Clarage Air Conditioning is enabling manufacturers to speed production, improve quality, cut down spoilage and increase profits. Clarage helps in textile mills, in cigarette and cigar making, in printing plants, paper mills, food plants and many other industries. We are prepared to help you!

● *Public favor and patronage goes to the shop, restaurant or theatre that is cooled in summer. For smaller places a Clarage Conditioning Unit is effective equipment. For conditioning an entire building, economy is promoted by using a Clarage Variable Capacity, Constant Velocity System.*



● *For fine homes Clarage offers the Duotherm, a complete air conditioning plant. The Duotherm cools in summer, warms in winter and controls humidity at all times. Its design is grounded in the same sound engineering which has made the larger Clarage Systems so successful.*

WHAT HAPPENS *when you invest in* CLARAGE AIR CONDITIONING?

AT the bottom of this page is expressed a single fact about Clarage Air Conditioning, perhaps the most significant—"*Every Installation Engineered to the Job.*"

To you, as buyer or user of air conditoning, this means that regardless of what your requirements may be, *we can furnish equipment to meet those requirements exactly.*

How can we be sure of such an assertion? First, because we have been in this business a long time, nearly a quarter century. No organization knows more about air conditioning than Clarage.

Second, because we build a complete line. We need not, nor do we try to adapt any one type of equipment to all cases.

Third, because the men who recommend and sell Clarage Air Conditioning are experts. We have no dealer organization. The Clarage engineer who contacts you is factory-trained, an authority.

What happens when you invest in Clarage Air Conditioning? Simply this: *You get the desired results—and you get them at minimum cost.* The equipment will be right, and it will be correctly applied.

Your inquiry is invited.

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

Covers Every Need

Clarage Air Conditioning is available to meet every requirement from the simplest cooling job to the largest, most exacting temperature and humidity control installation. We build both unit type and central station equipment—fabricated completely in our own shops.

25 Years —Pioneer

For nearly twenty-five years we have been a leading producer of air handling and conditioning equipment. In this field Clarage is a pioneer. Clarage Air Conditioning is installed in America's largest industrial plants, office buildings, theatres, hotels, etc.

Leaves No Problems

When it's a Clarage installation, there are no loose ends. Our service organization assures a clean-cut, satisfactory job. Clarage Air Conditioning is sold under definite performance guarantees, and these guarantees are backed by a financially sound, responsible company.

Money Saving Features

Clarage Vortex Control (patented), Constant Velocity Registers (patents pending) and our exclusive air washer features make possible important economies in both first and operating costs. Clarage Air Conditioning, combining modern engineering and advanced design, is a very attractive proposition.

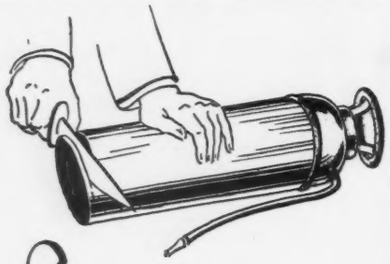
Definite Clarage Policy

This Company cooperates fully with architects, engineers and contractors. To the architect and engineer we endeavor to be helpful by furnishing complete technical data, etc. The contractor should know that using Clarage equipment does not involve any license fees whatsoever.

CLARAGE AIR CONDITIONING UNITS and SYSTEMS

Every Installation Engineered to the Job

SLICE DOLLARS OFF FIRE EXTINGUISHER MAINTENANCE COSTS



HERE is a way to wipe out your fire extinguisher maintenance costs. Old fashioned soda and acid extinguishers must be refilled every year, but the NEW Kidde extinguisher is good until used. Instead of a dollar a year for maintenance, the NEW Kidde extinguisher will cost you nothing.

The Kidde extinguisher is discharged by pressure supplied by a cartridge of carbon dioxide gas. It contains no acid. It discharges only pure water. The Kidde extinguisher has all the effectiveness of soda acid extinguishers and meets the requirements of insurance authorities. It is labeled by the Underwriters' Laboratories and the Factory Mutual Laboratories.

Why buy old fashioned fire extinguishers that cost money and trouble each year for maintenance? The new Kidde extinguisher costs no more initially and costs nothing to keep up. Write for a free copy of the folder, "The Fire Extinguisher that Saves Recharging Dollars," Walter Kidde & Company, Inc., Bloomfield, New Jersey.

NO ANNUAL RECHARGING

KIDDE PURE WATER FIRE EXTINGUISHER

the jobs and the men, and learn how to manage and control. He must see that each worker does his share of the work accurately and without too much scrap.

This procedure requires frequent contacts with the men. In other words, it means putting full control of production back in management's hands and out of the control of groups operating on a bonus plan.

One company has introduced a form of rating that is useful in a merit classification of workers. A man is scored on five counts—workmanship, conduct, application, attendance, and safety. On each count he may be scored: First Class (superior), Second Class (average), Third Class (tolerated only in case of labor shortage), and Unsatisfactory.

This rating was originally designed for picking out the (d) men and handling dismissals, but it is equally satisfactory for setting rates and supplying an incentive.

With a straight hourly rate in effect, the foreman's real job is to bring up the work of the weak producer and place him properly. If that cannot be done, the foreman must dismiss him. At the time this article was written (mid-December, 1934) there were relatively few cases of dismissal reported, but then the new production schedules were hardly under way, and mostly (d) men were working. What will happen when production is in full swing remains to be seen.

Watch Turnover

Another factor that will be watched with much interest is the one of labor turnover. Twenty per cent a *month* was not unusual in some plants last year. The attack on this problem is being made through foreman training as it is felt that faulty supervision was largely to blame. The much closer supervision required under the new wage plan is bound to have a beneficial effect.

Naturally, foreman training is concentrated at the moment on the employer-employee relationships. New texts have had to be prepared to acquaint the supervisory forces with the new wage payment plan and to re-educate foremen as to their added responsibilities. It has not been an easy task to develop enthusiasm for a new plan after the management had been selling them on the advantages of piece rates and bonus plans for the last quarter of a century.

In one plant an old timestudy man experienced in several forms of wage payment plans is devoting all his time to this sort of education, either in the form of group contacts, conferences, or personal contacts. In addition, the factory manager has been conducting meetings. In another plant where a department of industrial education was already in existence, the only change in routine was to prepare some new text material in place of the obsolete lessons on group bonus and group piece rates.

What of Costs?

It was mentioned earlier in this article that the same standard labor costs remain. In actuality this is probably what is going to happen in the present automobile year: During the first months of production, actual labor costs will exceed standard costs by reason of delays and difficulties in getting new tools and new line-ups working on the 1935 models. During the last few months actual costs will be under standard costs because all the "bugs" will have been worked out and the workmen will have developed added skill.

The net result will be that standard labor costs will average out over the life of a particular model.

Work of the timekeeping department will be greatly lessened on the new basis because a great volume of group calculations are eliminated. Work of the cost department will show little increase because the time standards must be maintained.

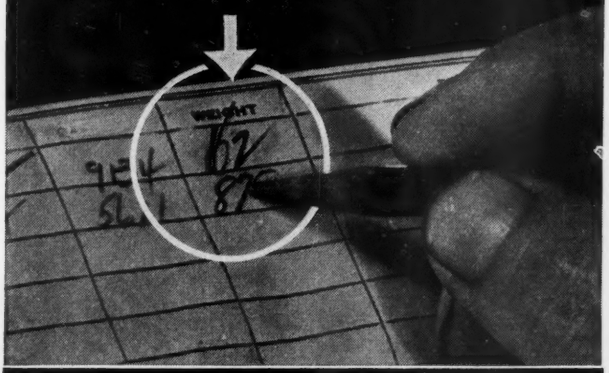
The conclusion reached after considering all the factors is that although the change from piecework and group bonus was made largely as a matter of expediency, advantages will accrue both to man and the management.

Old conceptions of a time method of wage payment must be altered. Other forms of incentive still based on the worker's self-interests have been substituted for the old stimulants. Compensation is still on the basis of the relative productive capacity of the worker; the management *knows* what constitutes a good day's work.

Greater Employee Satisfaction

From the management's point of view, the chief gain has been in keying up the whole supervisory organization to provide a uniform flow of materials and parts through the plant. Greater employee satisfaction will be achieved. One cannot help feeling, however, that the will of labor in the automobile industry could not have made itself felt thus strongly in the pre-Roosevelt era. It only goes to show how influential "collective bargaining" has become under the NIRA.

BIRTHPLACE OF LOSSES



IN THE TEXTILE INDUSTRY

Profit . . . PERHAPS

● Human errors are a notorious menace to profit. They are particularly dangerous in the stub-pencil records of basic weight figures which determine the accuracy of inventories, production costs and invoices to customers—all factors which control profit. And wherever weight figures must be *read, remembered* and *recorded,* human errors are inevitable. They are the Birthplace of Losses in your plant.

Profit Protected—The Toledo Printweigh eliminates all human errors in weight-recording. It certifies the accuracy of each weighing operation by delivering a positive and permanent printed record of each load placed on the scale. It prints from one to four copies in less than 1/10 second.

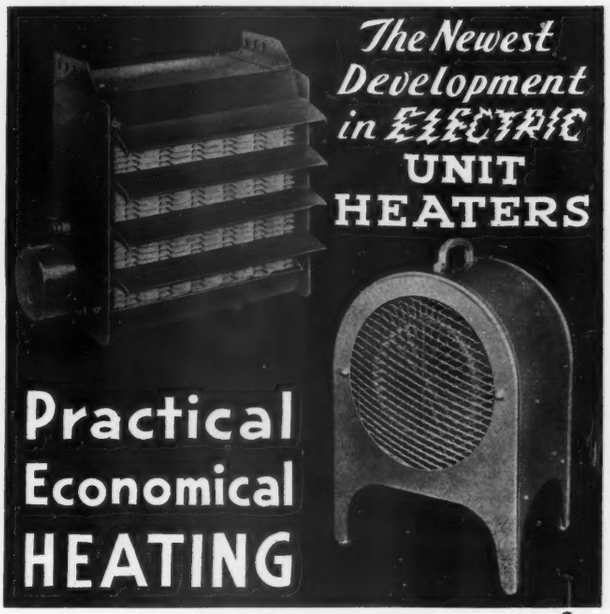
Investigate the many profit-protecting features of Toledo Printweigh records. Write for a copy of "Progress in Industrial Weighing"—a brief fact-summary of printed weight-recording. See "On Guard"—a Toledovision talking picture which presents Printweigh's profit-guarding features. Simply phone your local Toledo Scale representative for a showing of "On Guard"—in your office, at your convenience. No obligation, of course.

Act now, to eliminate stub-pencil weight records—the Birthplace of Losses in your plant.

TOLEDO SCALE COMPANY
TOLEDO • OHIO
NO SPRINGS • HONEST WEIGHT

181 SALES AND SERVICE OFFICES THROUGHOUT U. S. AND CANADA

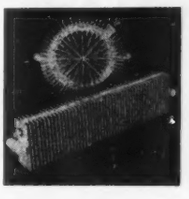
ELECTROMODE



ELECTROMODE is the most modern electric fan type unit heater on the market. Many laboratory and operation tests by Power and Public Service interests, Insurance companies, United States Government Departments and other authoritative institutions have approved Electromode Heaters and hundreds of users attest their practicability and efficiency for many and varied uses. Due to exclusive features every installation has shown a savings. Electromode Heaters are clean, trouble free, requiring no maintenance, easily and quickly installed, provide instant heating, 100% efficient, entirely automatic, reliable as electric lights. Supplies heat only when needed and just where wanted. Low equipment cost—minimum installation expense. Industrial and portable types illustrated each made in various sizes to suit all conditions.

Heating Unit

The exclusive heating unit is the heart of all Electromode Heaters. Special aluminum alloy fin type grids, illustrated, give greatest dissipation of heat in a given space. The large convection surface of the units enables operation at safe, low temperatures. These exclusive units enable smaller heaters with greater heat output.

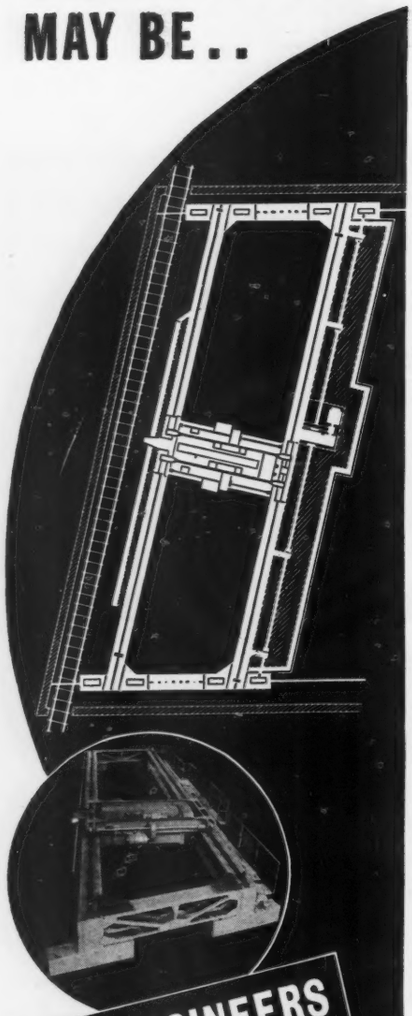


ELECTRIC AIR HEATER CO.
Mishawaka, Ind.

Mail coupon for a new catalogue on complete line of Electromode Heaters.

Name .....
Company .....
City .....
State .....

WHATEVER YOUR CRANE PROBLEM MAY BE..



P&H ENGINEERS HAVE THE ANSWER

A peculiar problem faced P&H engineers in designing a crane for Plant No. 37 of a prominent auto body builder at Detroit . . . the building ended diagonally to provide for a railway spur. The answer was a "skew" crane, traveling at a 77 degree angle, enabling the crane to unload cars which are spotted at this angle. Overhead clearance was limited.

As the world's largest builders of overhead cranes, P&H offers you a wealth of experience in crane application. Ask for catalog 450.

HARNISCHFEGER CORPORATION
4525 W. National Ave., Milwaukee, Wis.

P&H TRAVELING CRANES

An Approach to Profit

(Continued from editorial page 20)

and (3) $\frac{B_1D}{BB_1} = \frac{E_1D}{EE_1}$, for the same reason as in equation (1)

or (4) $\frac{B_1D}{AA_1} = \frac{E_1D}{EE_1}$, by substituting AA_1 for BB_1 in equation (3).

Dividing equation (4) by equation (2) gives:

$$\frac{B_1D}{A_1C} = \frac{E_1D}{G_1C},$$ which was the equation to be proven.

This formula is accurate only when we are dealing with both a common denominator like budgeted sales and budgeted costs, and two points each covering sales and costs.

If, however, more than two points covering budgeted sales and budgeted costs are used, or, still more important, if we deal with *actual* sales and costs for a number of months *greater* than two, then an entirely different formula is required. This being much more complicated (although simple to use in practice), and requiring considerable space in which to state and furnish examples, I shall not attempt its exposition in this series. Attention will be confined to budgeted situations on a two-point cost and sales basis.*

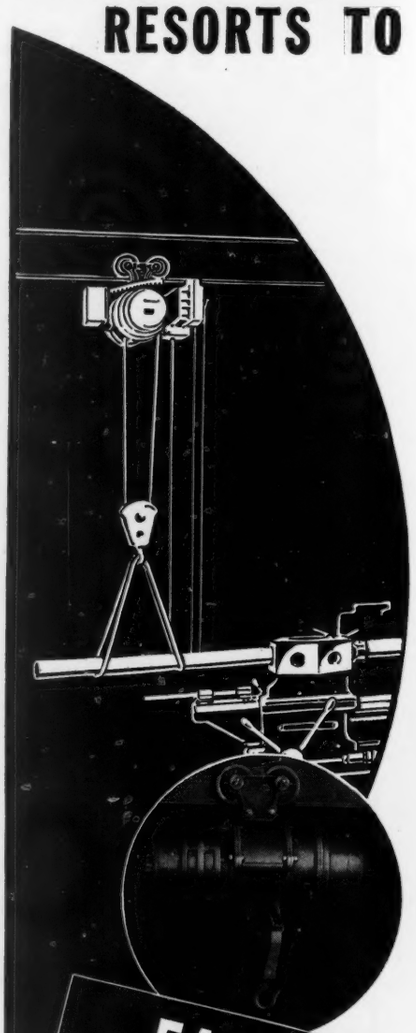
To What End All This?

To what end is all this? A Profitgraph presents a definite combination of product sales and the estimated or actual fixed and variable costs for this combination of sales by products or groups of products, and is representative only so long as the combination of product sales remains unchanged.

Just the moment we change the product proportions we change the economic characteristics owing to the different fixed and variable parts

*For these and other formulas of the Profitgraph and determination of fixed and variable costs, the author is indebted to Norman Lindstol, Edward Smith, E. G. Seybold, Arthur J. Minor (Chapter XV of "Profit Engineering," C. E. Knoeppel, McGraw-Hill Book Company), Dr. Walter Rautenstrauch (author of "The Successful Control of Profits," Forbes, and paper before December, 1932, meeting of American Society of Mechanical Engineers, on "The Economic Characteristics of the Manufacturing Industries"), and John H. Williams.

EASTERN PIPE MANUFACTURER RESORTS TO



FASTER HANDLING

The slow, laborious handling of large iron pipe, from floor to lathes with chain blocks, was responsible for a high over-all production cost. P&H Material Handling Engineers made their recommendations: Based on an average of 14 lifts per hour the P&H-Milwaukee Hoists speeded up operations by 37%.

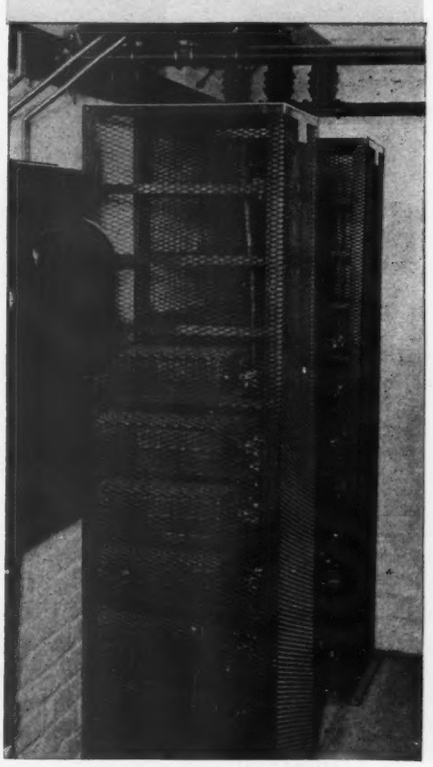
It's just one small way in which we have served thousands of users of material handling apparatus over a period of fifty years . . . ask for catalog RH-2.

HARNISCHFEGER CORPORATION
4525 W. National Ave., Milwaukee, Wis.

P&H MILWAUKEE ELECTRIC HOISTS

AGAIN POWER-FACTOR IMPROVEMENT REDUCES POWER COSTS

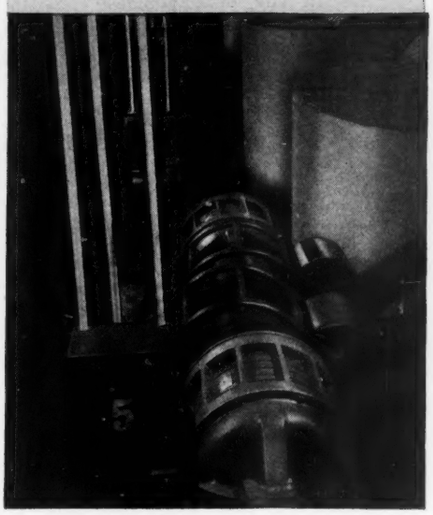
SAVES $200 A MONTH



MORE than a year ago, three G-E Pyranol, 460-volt capacitors, totaling 220 kv-a., were installed in plant No. 1 of the Sparks-Withington automobile-horn factory for power-factor improvement. The increased power-factor has resulted in savings averaging more than $200 a month.

The performance and savings from the use of this equipment convinced the company of the value in G-E capacitors and resulted in the installation of a second 140-kv-a. capacitor in another of the company's plants.

SAVES $3600 A YEAR



THE California Fruit Wrapping Paper Mills, Inc. of Pomona, California, found, after a thorough investigation, that it could save $3500 to $3600 annually on its power bill by modernizing its drives with dependable G-E synchronous motors and control. The installation of these G-E synchronous motors with their inherent high efficiency and their ability to improve power-factor is an important contributing factor toward these savings. General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

YOU TOO MAY SAVE

In hundreds of similar cases, the installation of G-E power-factor-improvement equipment — capacitors, synchronous motors, synchronous condensers—has improved plant operation and effected savings. In those cases where power contracts included a penalty for low power-factor and a bonus for its improvement, substantial returns have been made on the investment. Look into these savings. Simply fill in and mail the attached coupon; or, if you prefer, call the G-E sales office nearest you.

GENERAL ELECTRIC COMPANY
Dept. 6A-201, Schenectady, N. Y.

GET-541 ( ) GEA-77F ( )

Please send me your bulletins "Direct-reading Power-factor Improvement Chart," GET-541, and "Improving Power-factor for Profit," GEA-77F, as checked above.

Name.....

Firm.....

Street.....

City..... State..... 060-3

DeVILBISS SPRAY-FINISHING

Eighty All Wave Lowboy

FOR ~~CROSLEY~~ RADIOS

The Crosley Radio Corporation knows the importance of quality and efficiency in finishing operations—and uses DeVilbiss Spray-Finishing Equipment.

Smoother, more even finishes improve the appearance of your product—a definite selling advantage. And more efficient equipment means faster finishing at lower cost. These are sound reasons why successful manufacturers are standardizing on DeVilbiss Spray-Finishing and Exhaust Equipment.

Old-fashioned finishing methods, or even old-style spray-finishing instruments, have no place in modern industry. Near you is an experienced DeVilbiss representative. Let him tell you about the latest developments in spray-finishing, and their application to your particular needs. Send for him now, or write us direct.

THE DEVILBISS COMPANY · TOLEDO · OHIO

New York Philadelphia Cleveland
Detroit Chicago St. Louis
San Francisco Windsor, Ontario

Direct sales and service representatives available everywhere

DeVilbiss

of the different products or groups thereof.

Knowing what these changes in product groups are, or should be, and having a knowledge of the different fixed and variable costs, we can recast the Profitgraph in line with these changes, and take steps necessary to develop sales plans that will ultimately mean greater profits.

This places us in a position to budget costs (both on a normal and an "allowed" basis) as soon as production and sales figures are known after the end of any month, forecast profits, and indicate volume and inventory variations. Later in the month when the profit and loss statement is compiled and we know the actual profits for previous month, we can then determine the cost variations.

In other words, knowing the economic characteristics of a business, being able to develop intelligent sales plans, and having the mechanism for forecasting profits, an executive is in the best possible position to chart his sales course and pilot his business ship towards one destination—PROFITS.

[Next Month—
Profit Planning]

•

How Good Is Your Management?

(Continued from editorial page 13)

and at the least possible costs? These are questions whose answers rest squarely upon the facts.

Records must be simple; must be shaped to meet the specific needs of the executives who use them; must be provided promptly.

7. Development of Standards

The great objective of business and industry today is to measure what should be done—what must be accomplished in order to make a satisfactory profit.

Coupled with this principle of setting standards for every division of activity is the immediate presentation and analysis of variances from standards.

Only by a constant comparison of

And the years bring you DOUBLE ECONOMY

HAVE YOU READ "BUY IT BY THE FOOT?"

This interesting folder, giving proof of Permite's double economy, will be sent you upon request.

Permite is made in two types: Non-Corrosive for general use, and Heat-Resisting to 1000° F.

PERMITE Ready-Mixed Aluminum Paint offers you two *actual savings*, that will show on your cost sheets.

The first comes with your paint purchase. Permite's fine-screened pigment and exclusive synthetic vehicle assure far greater coverage, and increased ability to hide and protect. So you save when you buy it "by the foot," for you require far less paint *by the gallon.*

The second saving will show up on the cost sheets of three or four years hence. For when it's "repaint-time" for ordinary paint, your Permite-painted job won't need repainting. It will still stand, brilliant and protective!

Prove these economies for yourself by specifying Permite Aluminum Paint on your next paint job. Full particulars are yours for the asking.

ALUMINUM INDUSTRIES, INC., Cincinnati, Ohio

PERMITE DISTRIBUTORS IN ALL PRINCIPAL CITIES

PERMITE *Aluminum* PAINT

COSTS LESS "BY THE FOOT"

actual performance with predetermined standards can fall-downs and inefficiencies be checked before they become cancerous.

8. Measure Incentives

Profit sharing has long since proved ineffective as a plan for bonus rewards. Payments are too far removed and are not coupled with the definite savings accomplished by specific individuals.

In contrast, extra remuneration that is related directly to performance through the beating of standards affords both a practical and a scientific method of bonus payment.

This incentive principle can be and should be set up for all forms of industrial effort—for direct labor, indirect labor, sales force, minor executives, special or departmental executives, and major executives.

The building of a sense of proprietorship, which comes with incentives, creates constant dynamic effort.

9. Adequate Research

The avowed purpose of research is to ascertain from scientific investigation whether every phase of the industry is attaining its highest possibilities.

Changes in product, development of new lines, elimination of wastes, marketing of product and by-products, effectiveness of management—all are fields wherein research carries on its studies.

Thus research is the leading influence in keeping the enterprise abreast of the times. No concern can expend money more wisely than in making outlays that insure against decay and regression.

The principle of adequate research is a basic necessity to keep the concern ahead of the rest of the industry and to prevent its slipping into an inferior position.

10. Relation With Your Industry as a Whole

No specific enterprise can hope to prove successful over a period of time if the industry of which it is a part is unhealthy.

If within an industry are found concerns which attempt to live by such practices as wholesale price cutting, selling below costs (quite often because they do not know their costs), secret rebates, and other un-

WOULD A
Substantial
Saving in
HEATING COST
mean Something
TO YOU?

•

THERE IS A WAY in which practically any shop or office can make substantial reductions in heating expense—by the installation of Automatic Temperature Controls. In addition to the obvious benefits of uniformly proper temperature, and automatic operation without attention, this equipment will usually *pay for itself* in from one to three years.

•

BARBER-COLMAN CONTROLS are the most suitable for factory and office installations because of their adaptability, ease of installation, and moderate cost. The Barber-Colman system is based on low-voltage *electric* operation throughout. Thermostats, motor-operated valves, motor-operated damper controllers, and all necessary accessories are available for installation on any kind of heating, ventilating, or air conditioning system in any type of building.

•

IT COSTS NOTHING TO FIND OUT whether or not a Barber-Colman control installation will be to your advantage. Our men will be glad to make a preliminary survey and report their findings to you without any obligation on your part. Tell us your problem and we will see if we can help. Send for literature, if you want to read about our control equipment.

•

BARBER-COLMAN COMPANY
ROCKFORD, ILLINOIS

BRANCHES and REPRESENTATIVES in PRINCIPAL CITIES

Dolph's

BIG 3
for motor maintenance

1. CHINALAK
A high quality Black Baking Varnish that keeps motors running under the most severe service conditions.

2. ELECTRIC LACQUER
For 25 years DOLPH'S ELECTRIC LACQUER has set the standard of quality for black finishing varnish. Applied by dipping, brushing or spraying, it completely seals up holes, fills crevices and heals defects in the previous coat of insulating varnish. ELECTRIC LACQUER provides a finish that is absolutely oil and waterproof.

3. RED OILPROOF ENAMEL
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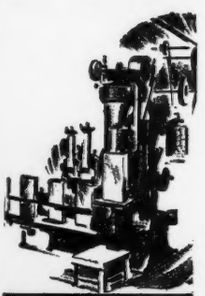

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The simple addition of Pyroil in small quantities to regular greases and lubricants supplies a process effective of safety and super-efficiency in machinery operation, plus a definite economy in maintenance, impossible to obtain through any other method. Pyroil cuts friction considerably. Reduces fire hazards.

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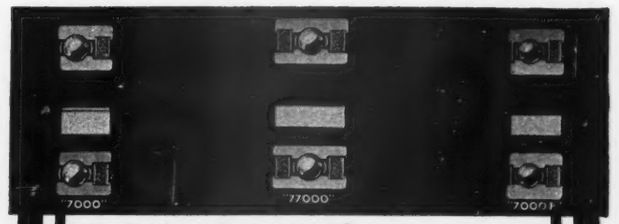

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RHOADS TANNATE LEATHER BELTS

TANNATE MAY SAVE YOU MONEY —it has for others.

On hard drives Tannate Leather Belting often outlasts oak belting three to five times; and frequently wears twice as long as special tanned belts of other makes.

One engineer speaking of his compressor drive said that it took 15 to 20 minutes to build up the required pressure, until he put on a Tannate Belt. Now, it can be done in five minutes.

For hard drives its great strength, strong grip and extra long life are so combined as to make Tannate Leather Belting an exceptionally economical power transmitting medium. Far better than V-Belts for short center drives, and probably unequaled for longer belt drives.

Let our engineers help you with your installation problems.

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RHOADS TANNATE

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There are large differences in investment, operating and maintenance costs between two systems of power application, namely, Unit Drive and Modern Group Drive.

Cost reduction is now the biggest problem before industry. Power-cost is today the greatest controllable factor in cost-reduction.

"We shall have to sell over seven million yards of additional production to make up for **just the carrying charges** on the difference in cost between these two methods of transmitting power to our machines." Thus a textile head summed-up the problem.

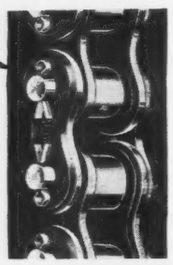
In a metal-working plant, additional production to the value of 7 per cent of the entire machine investment had to be sold to offset **carrying charges alone** on the difference in cost between the Unit and Group methods of applying motor power to the work.

An answer to the question of how to reduce costs is usually found through correction or modernization of power and transmission equipment.

Let the Rhoads Engineers help you with your problems.

Camels GET A LIFT

From Baldwin-Duckworth



and so do Chesterfields, Luckies, and a dozen others who use Baldwin-Duckworth roller chains in both manufacturing and wrapping machinery.

Reliability in any power transmission or conveying job can be yours by specifying Baldwin-Duckworth machine finish roller chain. It's available in any pitch and in single or multiple strand. You'll find Baldwin accurate-cut sprockets a sound buy, too.

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Please send copy of booklet "The Brush Phase of Motor Maintenance."

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sound trade activities, then the whole industry is certain to suffer.

Sound management policy for the individual company requires the establishment of a sound trade association properly managed to develop correlation and cooperation within the industry. The National Industrial Recovery Act recognizes this principle. It is part of the duty of management to develop and lead in trade association and code activities.

Rating Your Own Management

The ten principles listed above cover quite fully the field of industrial management. That some other principles could be added, is undoubtedly true. The ones noted here, however, have a high degree of being correct in that they were checked through several hundred successful and unsuccessful concerns, both large and small.

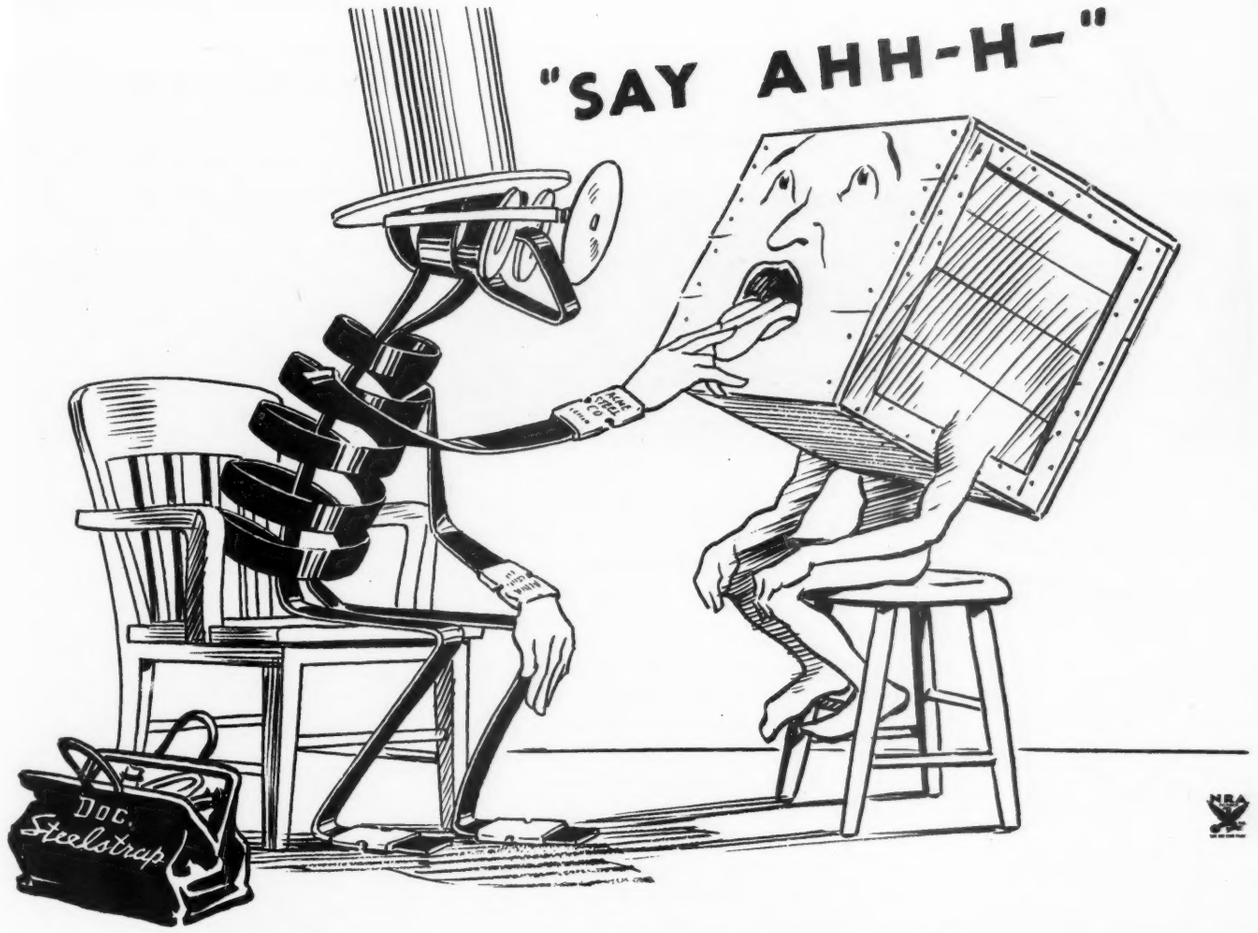
Perhaps a more important phase of this paper is the appraisal of your own management in terms of the ten basic principles set forth. To accomplish this I have developed the rating sheet shown on editorial pages 12 and 13.

On it I have listed not only the principles, but have indicated under three different columns those features that show the existence or nonexistence of the principle.

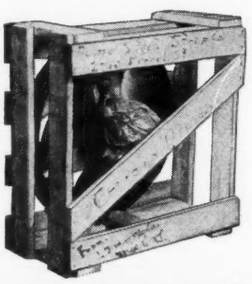
Those firms that qualify as "Superior" are the ones which without question are soundly managed and no doubt are enjoying successful returns. Those rating as "Average" are, if lucky, hardly breaking even. Those coming under the "Inferior" classification are hopeless. Do not worry about them as their place in industry will soon pass.

One can successfully wager that at least 85 per cent of the profits made in the manufacturing industries for 1935 will go to the firms rated as "Superior."

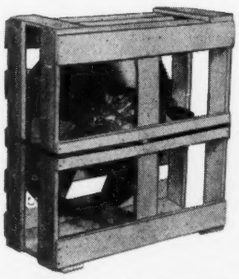
Why? For the simple and obvious reason that those enterprises have adopted scientific principles in their management. As progressive industrial managements do that, then the molasses-minded ones that operate by rule of thumb, guesswork, and hunches, are certain to be lost—eternally lost.



A check-up of your packages often uncovers hidden ailments Acme Steelstrap can cure



Here's the crate as it reached my laboratory—good design—but I bettered it—as below. Product—commercial fan.



Lighter, stronger and more economical with Acme Steelstrap. 10 lbs. lighter; it saves in container cost and freight, on an average trip, a total of 12.6 cents.

You know that the modern business man must keep himself fit, to give his best work to his job. And, it's the same with packages. An under-par box or crate isn't doing its best work.

That's why so many shippers have me check into their cases from time to time. Almost always, with Acme Steelstrap, I can brace them up—add to their strength—tone down paunchiness.

By helping to build more efficient containers, Acme Steelstrap saves thousands of dollars a year for shippers. It helps make packages travel for less money and take punishment without failure.

My colorful STRAP-BOOK gives *facts* about scores of cases made healthier, happier and more economical with Acme Steelstrap. Send for your free copy today.

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Of particular interest is the chapter on Sensitrol relays. These small contact-making indicators are capable of making contact on values down to 2 microamperes or ½ millivolt . . . operating and controlling directly from photocells, thermocouples, resistance thermometers and similar generators of minute energy. The contacts are capable of handling five watts at 110 volts, non-inductive load. They are furnished with single fixed contact, single adjustable contact, or double adjustable contact.

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WESTON SENSITROL RELAY
—makes contact on values down to 2 microamperes. Employs a new patented contacting method which assures perfect contact.

WESTON *Instruments*

Pensions— When, As, and If

(Continued from editorial page 23)

The cost of maintaining an organization to handle this plan would be excessive. There would have to be the Federal government, the association, and the industry itself, each with its separate pension organization and accounting system. I believe that industry would bear the full cost in the end.

Plan IV

The Plan—State industrial pension plans administered by our various states and imposing on all industry located within that state the requirement of compliance with a minimum pension plan or plans.

All contributions would be made to the state pension fund, and pension payments made to the pensioned worker after retirement by the state administration.

Comments—Here again we would have some 49 different state plans and bureaus to deal with, each perhaps a little different.

Perhaps we would have 49 different sets of costs and the usual political management.

Further, a different set of books would have to be kept for pension requirements in each state.

Again in the transfer of labor, either voluntarily or involuntarily, from one state to another, we would have the question of what to do with earned pension credits. Again we have the problem of increased burden in various state taxation plans.

Plan V

The Plan—A Federal plan applicable to all states putting upon industry the obligation of establishing pension plans.

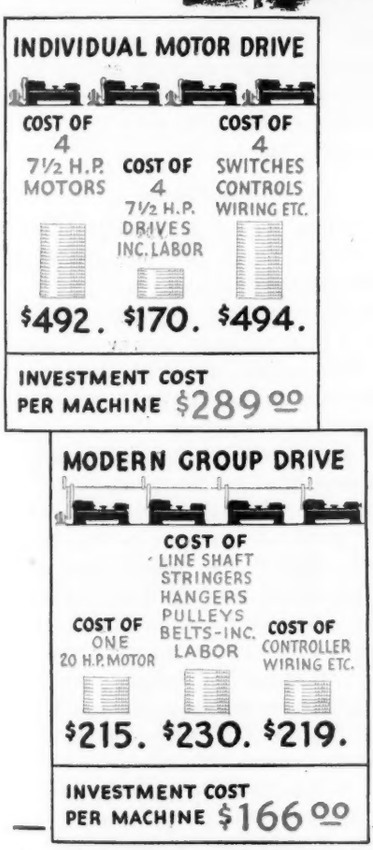
There would be set forth the minimum requirements believed to be adequate for the protection of workers, also the necessary machinery for underwriting any and all of this pension business offered by industrial companies coming under this law.

But the plan would give the right to choose any duly authorized carrier or underwriter for this pension risk—provided, however, all carriers or underwriters desiring to carry this

REDUCING POWER COSTS

CAN CHANGE A STATEMENT FROM

RED TO BLACK



MOST PLANTS can save money by preventing power waste, which is hidden somewhere in the total cost of power delivered to the production machines—enough money in many plants to change a deficit into a profit or to double existing profits.

There are two widely accepted methods of power transmission: *Unit Drive* (individual smaller motors) and *Modern Group Drive* (one larger motor for a group of machines). As an executive you do not need a study of your plant by an expert to appreciate the facts graphically illustrated at the left. Nor to see how related production machines can be grouped into a number of manufacturing units operated by larger and more efficient motors, at the same time maintaining harmony with production requirements.

Since certain departments in most plants permit of such grouping of machines, the possibilities of reduction in real power cost (frequently more than double the power bill) are too important to ignore. The facts have already been established through case studies in specific plants. These are available upon request.

Our Red Book, free on request, tells the whole story in graphic non-technical terms. Why not send for it today?

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(SPONSORED BY MECHANICAL POWER ENGINEERING ASSOCIATES)

An association of producers and distributors of power, power units and mechanical equipment for the transmission of power.

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MODERN GROUP DRIVE — PTC

This advertisement also appears in Business Week and 8 other publications.

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LOW COST

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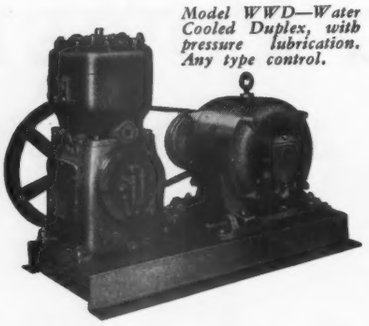
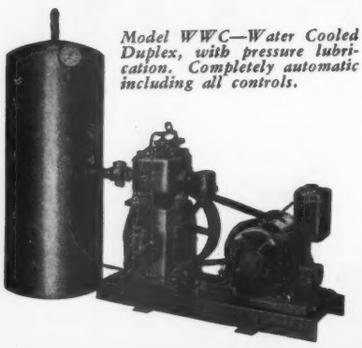


Model WWD—Water Cooled Duplex, with pressure lubrication. Any type control.



Model WWC—Water Cooled Duplex, with pressure lubrication. Completely automatic including all controls.

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It's adjustable, from zero to a constant saturation of the air stream. It guarantees smooth, efficient operation and *there's no other device that will do this job.* Once installed, no Norgren Lubricator has ever been taken off, because it saves far more than it costs. We ship it on trial to any responsible inquirer—if it doesn't make good on your equipment, it's no sale.

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Productimeters
THE SPEEDOMETERS OF INDUSTRY

risk be licensed by the Federal government and be under either federal or state supervision as our insurance companies are now.

Then companies could work out plans at least exceeding minimum requirements and more liberal if they so desire, and place the pension obligation with a licensed carrier of their own choosing on a competitive basis or with the government bureau as they see fit.

Should an insurance company be used as a carrier, the insurance company would furnish to the federal board a certificate showing the compliance of the company with the government plan.

Further there should be a license required with examination for all brokers of pension plans and they in turn be under either state or federal control.

Comments—First, we could use life insurance companies, now organized and qualified by experience and adequate financial resources to underwrite the requirements as set forth by law—just as industry now does for its other insurable risks.

We would have the benefit of sound advice on a highly technical problem. Costs would be known in advance. Because of competition among insurance companies for the business, they should be much lower than those obtainable from any governmental bureau.

Out of Politics

Pensions would be out of politics and in the hands of those qualified to handle the business.

Each industrial company could have a plan (always, however, equal to the minimum requirements) suited to its particular needs and those of its employees.

Under voluntary or involuntary termination of employment, there is no reason why the insurance company could not continue to function, because under the funded plan the pension would be fully paid for and would stand on the books of the insurance company as the property of that particular individual. At his normal retirement age, he would receive his pension direct from the insurance company.

By this method we have the benefit of a uniform law for all states, minimum pension requirements for all industry, and the advantages of private initiative and enterprise in the

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HAVE you plans for a product that calls for volume manufacturing? Have you parts that need improving or simplifying? Have you a manufacturing job that demands facilities or technical skill outside your field?

YOU and your problems have a standing invitation from Scovill — one of the world's largest manufacturers of metal parts and products. At your service at Scovill are skilled designers, sales experts, experienced production men — with manufacturing facilities for almost every conceivable metal part or product. Scovill manufactures for more than 3000 customers a year — over 5800 separate items of every size and quantity.

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NRA MEMBER U.S. WE DO OUR PART

management—with the alternative, however, of government operation for those who want it.

Provision for the raising of the minimum requirements should, of course, be incorporated in the law, for without such a provision we have no genuine social progress. Finally, we must not lose sight of the fact that pensioners must have an adequate income if they are to continue as the buyers of the products of industry.

Unemployment Compensation

(Continued from editorial page 24)

1934, it is the only law now on the statute books. Details of operation, as well as comments of Wisconsin employers, were discussed in the October article already mentioned.

In 1933, 68 bills were introduced in the legislatures of 25 states, 3 were offered to the 72nd Congress. In 7 states, a bill was approved by one branch of the legislature. In 16 of the 25 states, an unemployment compensation bill was introduced that conformed to the so-called "American Plan," a bill drafted by the American Association for Labor Legislation and sponsored by many other cooperating groups and individuals. See the accompanying table for its major proposals.

Another important proposal, also detailed in the table, is the plan offered by the Massachusetts Commission for the Stabilization of Employment. The Commission believes a compulsory compensation system is the best way to further the stabilization of employment—which in turn it believes to offer the best possibilities for preventing unemployment.

The same table includes the essential proposals of the Ohio plan which is typical of compensation bills that may be classified as "insurance" plans as distinct from the Wisconsin or "reserve" type of plan.

During 1934 only 9 state legislatures were in session, but in 5 of them a total of 35 bills to provide compensation were introduced.

Of these 35 bills, 10 provided for individual reserves, 7 for pooled reserves in a state-controlled fund. Contributions by employees were required in 8 of the 35. And in all but 1, employers' contributions were set at 3 per cent of payrolls.

In the 73rd Congress, meeting in 1933 and 1934, 5 unemployment compensation measures were introduced during the first session, 8 during the second. Of them, most important is the Wagner-Lewis Bill, which proposes to levy a 5 per cent tax on payrolls of all employers of 5 or more persons; contributions made by employers to a state-wide unemployment compensation system would be deductible.

The Deane Plan

One more plan—the Deane Plan—is said to meet with a degree of favor in Washington. A quick summary is given here.

The Deane Plan represents the engineering approach — aims at security for the worker by permanent elimination of unemployment and by sustained buying power, and promises security for the employer

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"I always find out all about its history, Jim. Only Time tells the truth about pipe."

For help with pipe problems, write

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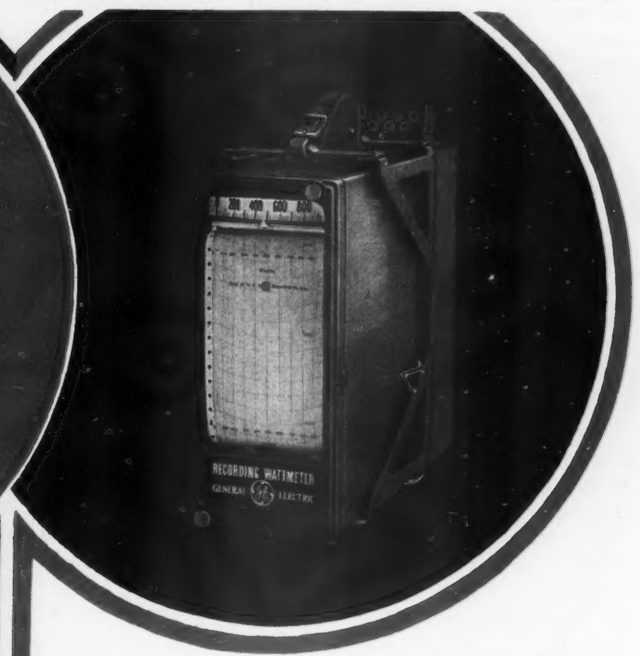

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YOU can know the operating conditions of your motors and power circuits by using G-E portable test instruments regularly. They will enable you to spot costly, inefficient, underloaded motors, and unreliable, overloaded motors and power circuits. They may be used to check your lighting circuits to see that your lamps are burning at their rated voltage.

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Note in the illustration how compact these instruments are—and how the terminals, glass, and scale are protected by the cover. Remember, too, that these instruments are constructed for permanent accuracy and long-time service, and that their degree of accuracy is higher than that usually found in low-priced instruments.

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G-E recording instruments will give you a "picture" of operating conditions in your plant that is beyond question — a "picture" showing accurately the peaks of load that are so important in determining your power rates.

They will catch and record the facts necessary for analyses of your plant operation. When placed in the power circuits that feed a plant, they will show how much time is wasted, by telling graphically how long it takes, each morning, for the plant to reach normal productive activity. On individual pieces of equipment they will reveal stories of idle time, or show details of operating cycles. On interrelated equipment they will show whether or not each part is performing properly in relation to each other part.

G-E recorders are available in both portable and switchboard types. Their price enables you to have adequate measuring equipment with a very reasonable investment.

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through a sustained market for the goods and services he sells.

It would cover 65 per cent of the total working population, include all persons receiving less than $60 weekly (or any other arbitrary figure), exclude agricultural and domestic workers.

It would require the establishment of Long-Time and Monthly Averages.

At the close of each year, average weekly hours of employment for all eligibles would be computed for the previous ten calendar years. This Long-Time Average would represent the highest average level of employment attained during the period.

At the close of each month, average weekly hours for the month would be computed from reports made by employers.

The Long-Time Average would be official for the following year; the Monthly Average for the second month following. Both averages would be calculated by dividing total man hours reported by total number of employees as of the last day of the period reported plus those registered for employment.

Whenever the Monthly Average was below the Long-Time Average, the pay of every eligible would be supplemented from a National Reserve Fund by an amount equal to 1 per cent for each hour or fraction thereof. Example: Assume the L.-T.A. is 40, the M.A. 36. Assume the employee receives $25 a week. From the National Reserve Fund he then receives 4 per cent or $1 in *supplemental compensation*, making a total of $26.

Tax on Payrolls

Who would pay? Every employer would pay a payroll tax into the Fund, but only when an employee was employed in any six months' period (January to June, July to December) more average weekly hours than the Long-Time Average. Tax rate would be 1¼ per cent of the total pay of such employee for each excess hour. Example: Assume L.-T.A. for 6 months' period is 40 hours. Assume employee worked a total of 1,118 hours and received $670.80. Average week would then be 43 hours (1.118 ÷ 26). Average weekly excess would be 3 hours, making the tax rate 3¾ per cent. Total tax would then be $670.80 × 3¾ per cent = $25.15.

Employers would pay employees any *supplemental compensation* to which they were entitled and would be reimbursed immediately from the National Reserve Fund.

Prospects for Legislation

What are prospects for legislation in 1935? The legislatures of 43 states meet in January. Steps have been taken to introduce the "American Plan" in every one of them. Without doubt many other proposals will receive serious legislative attention during the coming year.

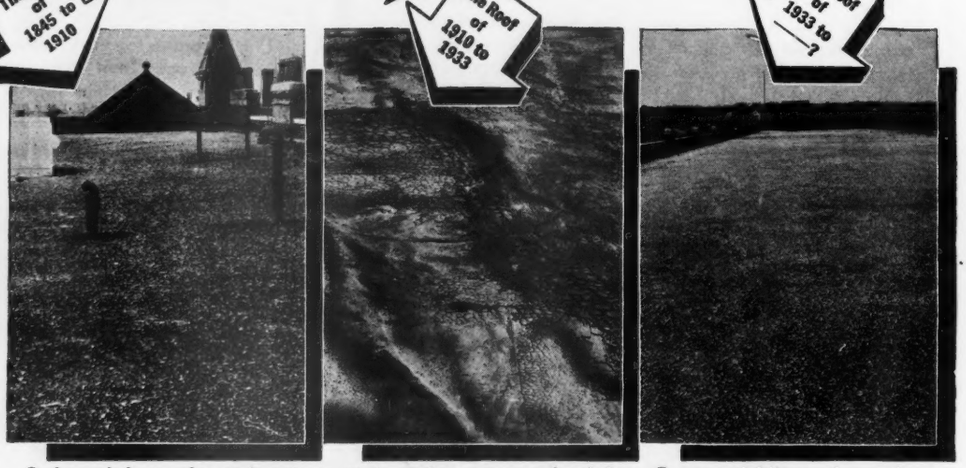
Details of the President's program have not yet been announced as this issue goes to press, will probably be available shortly after the new Congress goes into session.

What those details will be, however, is not exactly anybody's guess because we have the report (December 14) of the Advisory Council of the President's Committee on Economic Security. The Council proposes Federal-State unemployment compensation administered by the

NO. 12

The Greatest ROOFING Failure

THE cause of many roofing failures was the swing to smooth top roofings on flat decks. Most of those roofs have shown that four to eight years is about their life. Today many roofers refuse to stand back of any smooth top roofing on flat decks. They insist that only built-up construction, using coal tar pitch, tar saturated felt or fabric and gravel or slag protection, will last on those roofs.



Coal tar pitch was almost alone in the field. Roofs lasted 25 to 50 years.

Pitch roofings were replaced by other bituminous roofings. Many of these roofs failed in 4 to 8 years.

Because of failures of smooth-top roofings, the swing is back to pitch and gravel.

Other Koppers Products:

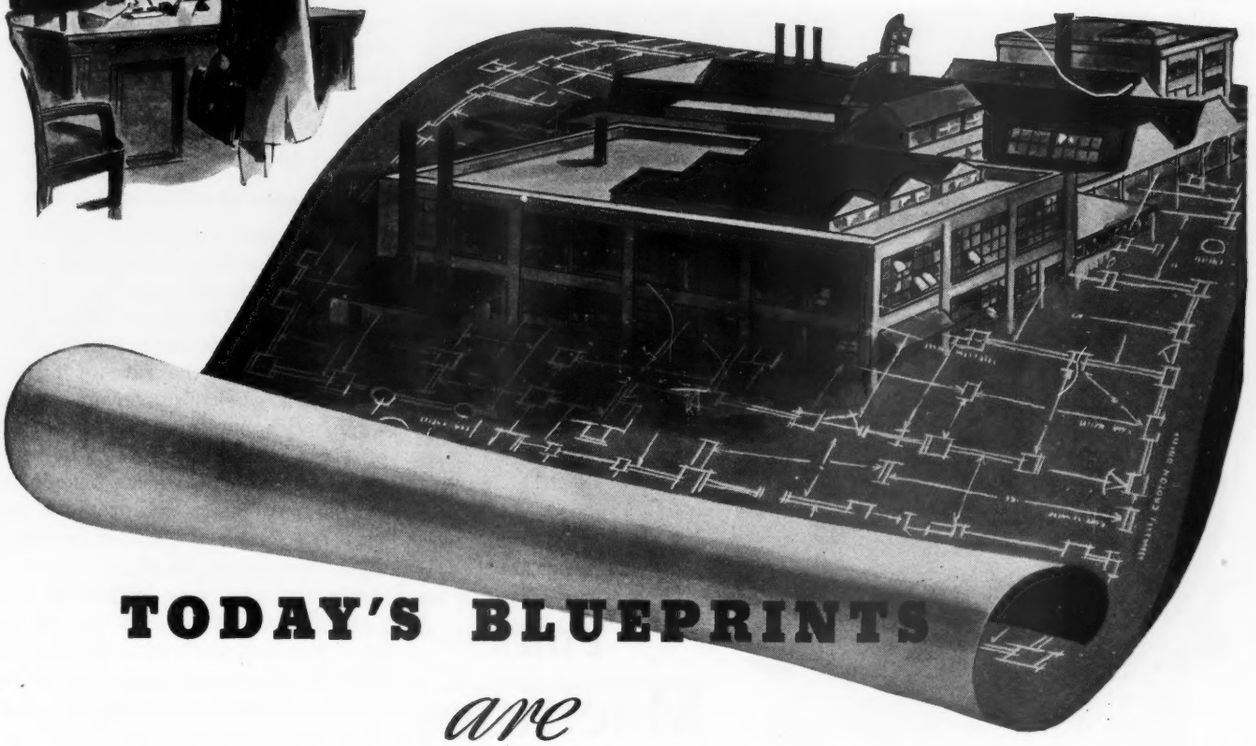
Membrane Waterproofing; Dampproofing; Tar Aluminum Paints; Plaster Bond Paints; Tarmac Road Tar for Streets, Pavements, Drives, Highways.

KOPPERS PRODUCTS COMPANY
KOPPERS BUILDING, PITTSBURGH
Birmingham Boston Chicago New York
Providence St. Louis

For Roofing and Re-Roofing Specify
KOPPERS COAL TAR PITCH
KOPPERS TAR SATURATED RAG FELT
A GRAVEL OR SLAG SURFACE

NRA WE DO OUR PART
KOPPERS

"You can be sure of one thing—when our plans go through, they will include your Taylor Temperature Control."



TODAY'S BLUEPRINTS *are* TOMORROW'S PLANTS

Will they provide for the most efficient and economical temperature control? Let us help you plan for it NOW.

HERE'S an actual case of far-seeing management. A superintendent already has plans on paper to improve the physical layout of his plant. He has decided on needed modern equipment, including Taylor Temperature Control. He is looking ahead to assure higher and more uniform product quality, greater operating efficiency and lower costs. When economic conditions permit, he is ready to turn blueprints into physical assets.

Wherever exact control of temperature is essential (and that includes practically every industry), Taylor Instruments are operating accurately and efficiently to assure uniform high quality production at lower cost. From the textile mills of the northeast to the canneries of the Pacific Coast, from the paper mills of Canada to the oil refineries of the South, plants of all kinds are proving that a Taylor Control System is one of the most profitable things they ever installed. These systems save thousands of dollars on comparatively small investments. They begin to pay dividends quickly, for they usually pay for themselves in a year's time.

Here is the one basic reason for all this: A Taylor Control consists of a specially engineered, unified system of accurate, durable indicating, recording and controlling instruments, built to fit a plant's special needs and installed under strict supervision.

Look into Taylor Control Now

It is sound management today to investigate every possible method for making your plant an even more efficiently operating unit. Find out just what Taylor Control can do for you—on temperature, pressure or flow.

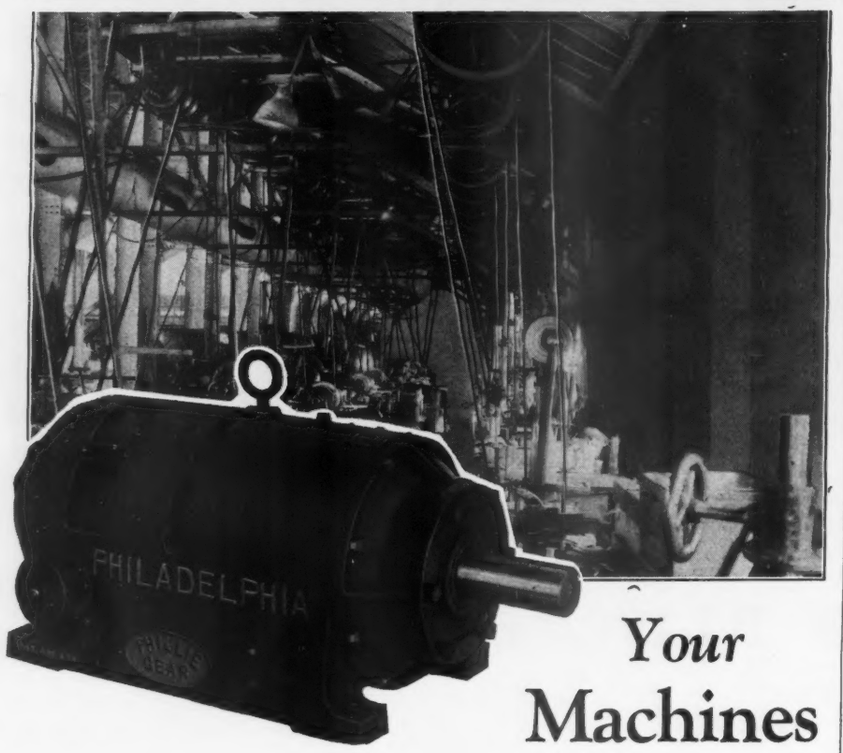
Let a Taylor man survey your present set-up now, even though economic conditions may delay putting more extensive control into operation. Then you'll be ready to profit from it quickly at the right moment. For this help, address the Taylor Sales Offices in Atlanta, Boston, or Toronto, Canada. Or write Taylor Instrument Companies, Rochester, N.Y.

Taylor

Indicating | Recording • Controlling

TEMPERATURE, PRESSURE *and* FLOW INSTRUMENTS

MODERNIZE



Your Machines

with *self-contained DIRECT DRIVES* ~

by installing the

PHILADELPHIA

MOTOREDUCER

By MODERNIZING your machines, we mean installing drives that will help to REDUCE PRODUCTION COSTS, as one means toward making profit.

Hundreds upon hundreds of Philadelphia MotoReduceRs have been installed throughout industry during the past several years — there must be a REASON for such WIDESPREAD ACCEPTANCE.

JUST CONSIDER THESE ADVANTAGES: *Space saving—Motor and Reducer are "in-built"* (preventing misalignment; making the unit dust, dirt and fume proof; doing away with a flexible coupling; saving time and expense in handling and installing same) *—Saves power* (efficiencies up to 97%)*—Unit is balanced* (preventing noise and vibration)*—Requires only occasional oiling—Gives extremely long, trouble-free service life.*

"Send for the new MotoReduceR *Catalog"*

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducing Units

Main Office and Works—Erie Ave. and "G" St., Philadelphia, Pa.

New York—330 W. 42nd St. Pittsburgh—Chamber of Commerce Bldg.

states and provides for a Federal subsidy to states adopting plans that comply with certain national standards.

Advocates of this new plan claim important advantages over the Wagner-Lewis Bill. For one thing, the latter would provide for no government control. Whatever the state plan, the government would be forced to credit employers with the amounts paid by them under state programs.

Advantages of the Council's Plan

The Council's plan, on the other hand, enables the government to set certain standards and to withhold the subsidy if the states do not meet them. Minimum requirements provide benefits at the rate of 50 per cent of a worker's average weekly wage, with maximum compensation of $15 a week, payments to be made on a ratio of one week's benefit for every four weeks of previous employment, after a waiting period of from two to four weeks.

To finance these subsidies, the Council then proposes a payroll tax of 3 per cent with no contributions from employees, arguing that the tax will be passed on to consumers and that beneficiaries would thereby pay their share. A state might, however, increase minimum payments, reduce the waiting period, and increase the number of payments by drawing funds from employees as well as employers.

Subject to these minimum standards, the states would be allowed wide latitude with respect to the particular form and provisions of the compensation laws they would enact. Such laws, however, would have to be completely divorced from relief.

The plan would, it is believed, run less risk of unconstitutionality compared with the Wagner-Lewis type of legislation when the latter is equally equipped with provisions for minimum standards.

Questions and Answers

(Continued from editorial page 47)

will prevent the operator from receiving a shock.

Removing the ground from the armature core in Figure 2 will cause a spark seen while testing to disappear.

The insulation tester undoubtedly gave a correct indication of the ohmic

SLIDING YOUR FINGER can tell you a "Gripping Story" about KABLE KORD FLAT BELTING

Slowly and lightly—across any smooth surface (your desk top is as good as any)—slide your finger. Then—SUDDENLY—bear down. What happens? Your finger STOPS!

In that simple slide of your finger you demonstrate why Kable Kord has a *greater grip.* Pressure! As pressure stops your finger, so does the pressure of Kable Kord's contactor belt upon the pulling cords provide a snug, sure grip against the pulley. Pressure is the backbone of Kable Kord's "two-belts-in-one" principle — and the reason why Kable Kord, on flat pulleys for group drives, short centers and pivoted motor bases, has *more pull per square inch than any other flat belt made!*

Kable Kord is amply flexible and requires no belt dressing of any kind. Its ruggedness, flexibility and *snug grip* mean, on any group or unit flat belt drive, increased efficiency — low operating costs — more profits!

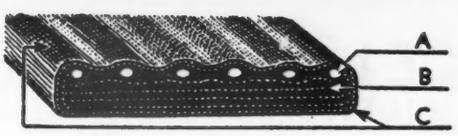
Kable Kord is, without question, the finest flat belting ever made. We urge you to have the Gilmer Transmission Man, when he calls, give you the complete story about Kable Kord. But, before then — today — write for the Kable Kord Data Book. It's full of interesting highlights about this revolutionary flat belting.

L. H. GILMER COMPANY, Tacony, Philadelphia

MANUFACTURERS OF V-BELTS, SPEEDAGE ENDLESS FABRIC BELTS, KABLE KORD BELTS

KABLE KORD'S *Advantages . . .*

1. Made endless and in rolls
2. Increases production
3. Reduces slipping
4. Has minimum stretch
5. Is more flexible
6. Has inherent ruggedness
7. Has more pull per square inch
8. Wears longer
9. Requires no belt dressing



Showing cross section of Kable Kord. "A", the contactor element, holds the pulling cords "B" snugly against the pulley. "C" is the outer jacket made of heavy fabric, that protects all cords and forms the "two-belts-in-one".

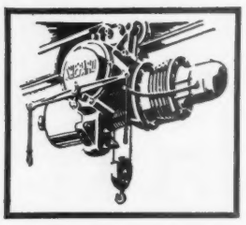
Gilmer BELTS

GILMER V-BELTS

You can depend upon them to deliver dependable, maximum power at all times. They're constructed of *three* compositions of tough, heat-resisting compounds. In thousands of plants, they're proving to be the most economical V-Belts on the market.

SPECIALISTS IN QUALITY BELTS SINCE 1903

shepard electric hoists



Exclusive Features: 1. Balanced Drive, at two points diametrically opposite. 2. Perfect alignment, maintained by all parts rotating around a common axis. 3. Automatic Oil Bath Lubrication. 4. Control by rope, push button, outrig or controller for every hoist. 5. Precision variable speed control for both A. C. and D. C. 6. Variety of speeds, types, lifts and capacities precisely suited to any service. *Write for complete data.*

Shepard Niles Crane & Hoist Corp.
364 Schuyler Ave., Montour Falls, N. Y.

Silent
Water Proof
Long Wearing

CELORON
SILENT GEARS

Celoron Silent Gears absorb shock and vibration, reduce wear on bearings and mating gears, insuring longer machine life. Celoron Gears are furnished by all leading gear cutters.

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CONVEYOR and ELEVATOR
BELTS

VEELOS
BALATA
BELTING

On account of its Great Endurance, its enormous Tensile Strength and Wear-Resisting Qualities use Veelos Balata Belting for wet and abrasive service. Its service cost is cheaper than that of any other belt.

Its Flexibility Permits It to Trough Sufficiently, and being homogeneous throughout it has a wearing surface of Extraordinary Strength down to the last ply. For conveyor and elevator service it will give you better, longer and more economical service than any other belt.

Send us your specifications and our engineers will recommend the proper Veelos Balata Belt.

MANHEIM MANUFACTURING AND BELTING CO.
Main Office and Factory: Manheim, Pa.

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resistance of the insulation; the shocks and sparks were due to combined flow of current through high resistance and electrostatic capacity or, when the insulation resistance showed infinity, were due to flow of current through electrostatic capacity alone.

W. B. CREAGMILE
James G. Biddle Company
Philadelphia

Why Do Holding Coils Burn Out?

Burning out of the holding coils of two 440-volt, three-phase magnetic switches has caused us much trouble recently. These switches, which are rated 15 and 25 hp., respectively, are several years old, but gave us no trouble until about a year ago. Then the coil in one switch burned out suddenly. Shortly after it was replaced the coil in the other switch failed. Each coil has burned out two or three times since then. These switches have been carefully inspected and are in good condition. They seem to operate properly until the coils burn out. The only unusual action I can notice is that sometimes these switches hum. What is the cause of these burn-outs, and how can I prevent them? A.K.E.—St. Louis.

THE TROUBLE may be due to an open shading coil. In the question it is stated that the armatures of the clappers have a tendency to hum. This circumstance, coupled with the fact that several coils have burned out during the past year, leads me to suspect that the trouble is due to the shading coil (usually a single turn) being open. An open shading coil would allow the holding coil to carry excessive current. CHAS. A. PETERSON
Electrical Department
Bendix Products Corporation
South Bend, Ind.

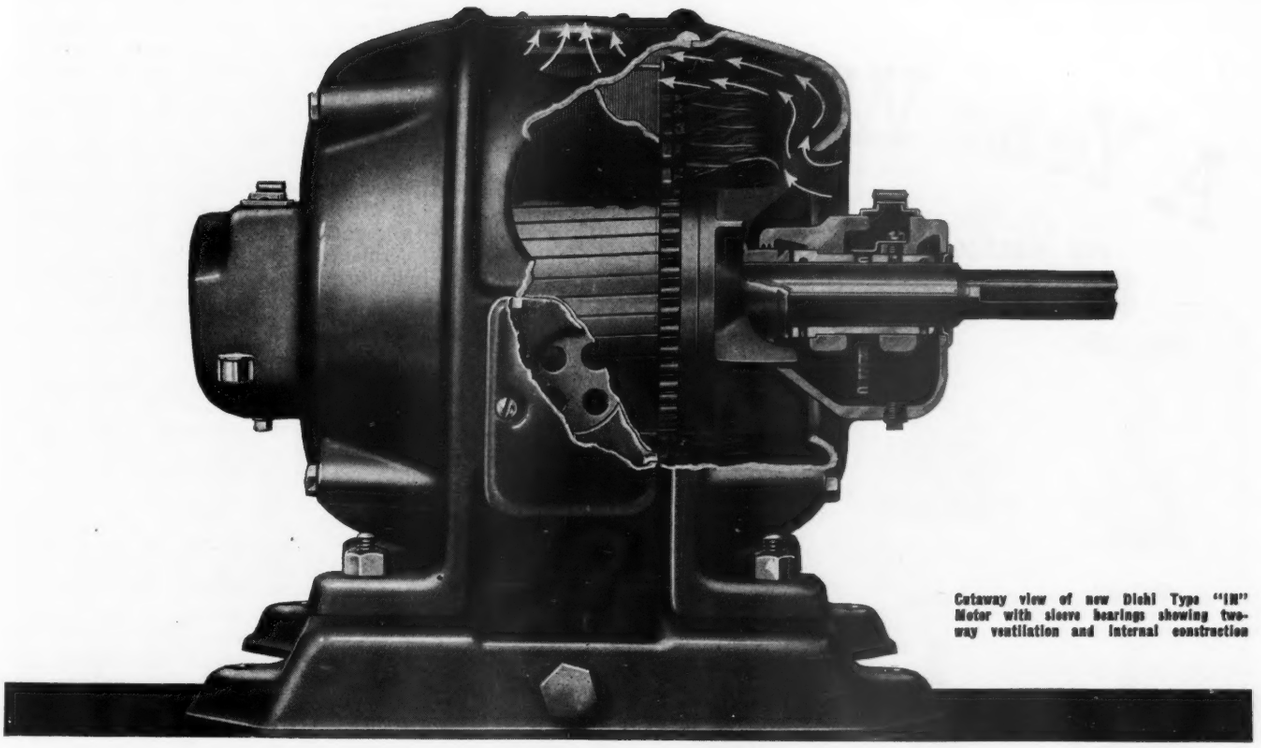
Method of Marking Wooden Floors

I wish that readers would tell me the best method of marking aisles, storage spaces, and the like on a wooden floor. It is necessary to have some method of marking that will withstand heavy trucking and scrubbing with soap and water, without being too expensive to install and maintain.

K.W.F.—Chicago

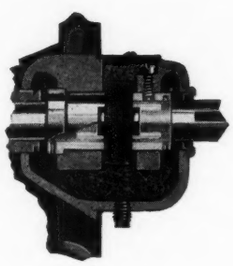
ONE of the simplest methods of marking a wooden floor is to use circular tiles made of a white rubber compound. Any rubber company will be able to furnish this kind of material. A good size would be 2 to 3 inches in diameter, and from ⅛ to ¼ inch thick.

Mark off the aisles with white chalk and space off the line in lengths of 12 to 18 inches, less if desired. With a

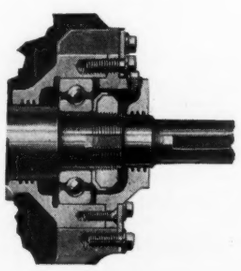


Cutaway view of new Diehl Type "IN" Motor with sleeve bearings showing two-way ventilation and internal construction

IMPROVED VENTILATION GIVES LOWER OPERATING TEMPERATURES



Waste-packed bearing.



Cartridge type ball bearing.

Two special rotor fans shrunk on shaft . . . smooth flowing air streams . . . unrestricted intakes and outlets . . . and smooth glass-like windings give Diehl "IN" motors a ventilating system that provides unusually efficient cooling and is not likely to become clogged by dirt, dust and other flyings.

Forty-one important features make "IN" squirrel-cage motors ideal for machine tools, pumps, blowers, hoists, conveyors and hundreds of other industrial applications.

High starting torque, super-insulation, quiet operation, long life and low maintenance are built into these motors. Dimensions are N.E.M.A. standard. Motors with special shafts, bearings and mountings can be furnished quickly. Diehl service stations are nationwide and Diehl Engineers will gladly give you the benefit of their half-century experience in serving leading manufacturers and industrial plants.

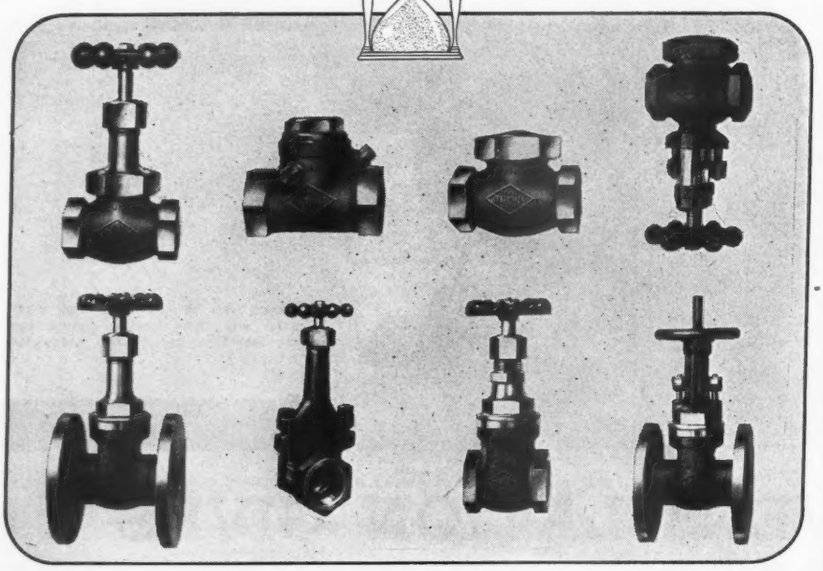
Bulletins covering practically all standard Diehl motors from the smallest fractional sizes up to 50 HP. A.C. or D.C., are available on request.

Write to Diehl Manufacturing Company, Elizabethport, New Jersey, or to Offices in Atlanta, Boston, Chicago, Dallas, New York and Philadelphia.

DIEHL MOTORS

DIEHL MANUFACTURING COMPANY, Electrical Division of THE SINGER MANUFACTURING COMPANY

A Year Well Spent *in Valve Development*



In the past year Jenkins developed
FIFTEEN NEW VALVES
to meet your needs...

SEVENTY TIMES, Jenkins has begun a new year with an inventory of the past year's accomplishments. Every past year seems the best. Measured in advancements in design and new valve types to better serve valve users we are especially proud of our record in 1934.

In the list of new Jenkins Valves developed in the past year you will undoubtedly find answers to your needs. Certainly, you will be impressed with the manner in which Jenkins Valves keep pace with engineering and industrial progress.

Get Details on New Jenkins Valves

New Bronze Valves: Spring-loaded Air Compressor Check Valves; Ball Check Valves; Regrind-Renew Valves for 300 lbs. S.W.P., in plug-seat and bevel-seat patterns; Regrinding Swing Check Valves for 300 lbs. S.W.P.; Bronze Gate Valves for 150 lbs. S.W.P., in traveling spindle, stationary spindle and O.S.Y. patterns; Bronze Gate Valves for 100 lbs. S.W.P.; Special Locomotive Blower Valve. *New Iron Valves*: Iron Body and All-Iron "Twin-Bolt" Gate Valves; Special Stuffing Box for Water Works Valves. *New Steel Valves:* Cast Steel Swing Check Valves.

A letter will bring complete details on any of these new Jenkins Valves. They will be fully covered in a Supplement to the Jenkins Catalog which will be issued soon. To get a copy, have your name put on our list, now.

Jenkins Bros

JENKINS BROS., 80 White Street, New York, N.Y.; 510 Main St., Bridgeport, Conn.; 524 Atlantic Avenue, Boston, Mass.; 133 No. Seventh St., Philadelphia, Pa.; 822 Washington Boulevard, Chicago, Ill.; JENKINS BROS., Limited, Montreal, Canada; London, England

JENKINS VALVES · SINCE 1864 · BRONZE · IRON · STEEL

brace and bit bore a shallow hole that will make the rubber marker a tight fit in the floor and have it flush. Suitable glue, nails, or screws can be used to hold the markers tightly in place.

Markers spaced in this way will make a line that is easy to see, easy to wash and scrub, and that will withstand any abuse the floor is subjected to without showing any wear, as would a painted line. Such markings are permanent, but the location can be changed if necessary and the holes left can be filled with wooden plugs.

J. DECKER, *Passaic, N. J.*

ONE WAY of marking storage space and trucking aisles on wood floors is to use an ordinary tennis court marker with a heavy-pigmented titanox paint, such as White Snolite, manufactured by the Pittsburgh Plate Glass Company, or White Fume-Proof Enamel, manufactured by the Glidden Company. This is a gloss paint and will withstand trucking fairly well. It is necessary, of course, to repaint from time to time, since nothing that we know of will stand up under exceptionally heavy trucking, unless one goes to the expense of setting in flat steel bars flush with the floor and screwed to the sub-floor on approximately 6-inch centers.

If the area to be painted is small, I suggest that K.W.F. nail two 2-inch wood strips approximately 1 inch apart and, using these as a guide, paint the marking lines by hand through the opening between the two boards. This is the method used to a certain extent on highway marking. The strips are usually from 10 to 12 feet in length.

E. S. FENELON
H. J. Heinz Company, Pittsburgh

Heating System for Garage

Our garage is built of masonry, one story high, and measures about 142×44 feet. There is no basement below it. I should like to have recommendations as to the most suitable and economical method of heating this building, considering first and operating costs.

R.I.C.—Providence, R. I.

OUR EXPERIENCE has been that for heating buildings similar to the garage described, there is nothing better than fan-type unit heaters. Such heaters will provide the most suitable and economical method of heating, considering first and operating costs.

M. M. GOOCH
Atlantic Highlands, N. J.

Why This Voltage Drop?

We have been troubled by excessive voltage drop in a plant having a connected load of 75 hp., at 440 volts, three-phase, 60 cycles. The largest motor is a 40-hp., 1,200-r.p.m., double-squirrel-cage, high-torque induction motor that

MERELY because it CAN be done

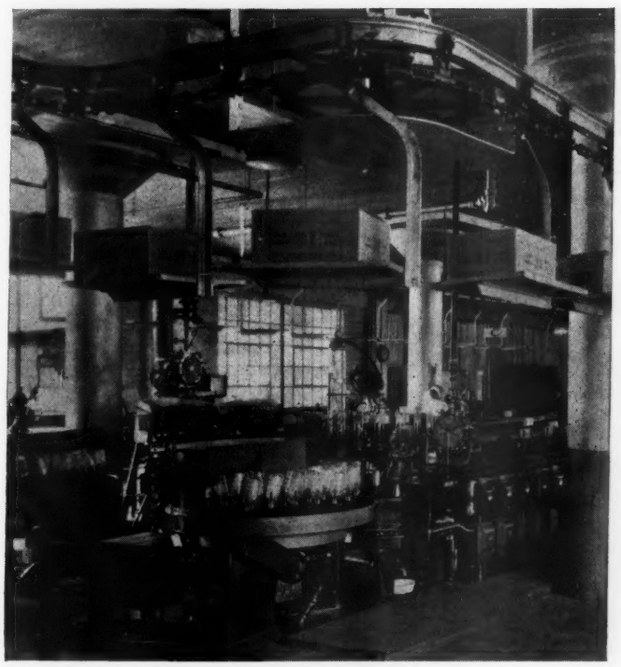
. . . Will not induce any barber in sound mind to throw away his razor and use an axe to shave his customers. Nor will it induce his customers to allow him thus to show his exceptional skill.

Similarly, you *can make* almost any conveyor do almost any job. But why? Real efficiency and maximum economy can be obtained from only one conveyor . . *the conveyor that exactly fits any particular job.*

That's why Jeffrey builds many types of conveyors for handling loose and packaged materials, unit products . . belt, chain, cable, pan, spiral, carrousel, pivoted bucket, V-bucket, wood apron, steel apron, reciprocating, monoveyor, scraper and trolley (described at left) . . also portable conveyors (belt, scraper and bucket types), for loose material . . and stackers (wood flight and chain types), for packages or unit products.

Why not lower handling costs, increase production, save floor space by installing efficient Jeffrey handling systems? They pay for themselves in a surprisingly short time.

Literature sent on request, or if you prefer a Jeffrey Consulting Engineer is at your disposal. Write today.



JEFFREY TROLLEY CONVEYORS

Make production march rythmically to and from machines . . . down to bench level, up over head to other processes . . . thru ovens, cooling tanks, spray booths, etc. . . . to packing and storage rooms, or shipping platform. Jeffrey Trolley Conveyors save floor space, eliminate congestion around machines, leave aisles clear . . . and they fit most any factory layout. Write for data.

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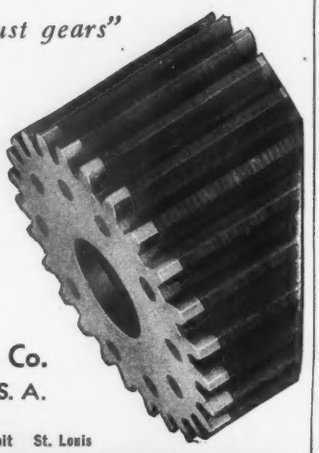
CHICAGO RAWHIDE

MECHANICAL LEATHERS • • LEATHER PARTS and PRODUCTS • • for every Industrial Use

Take *all* the wear - - still wear *longer*

Stop buying "just gears"

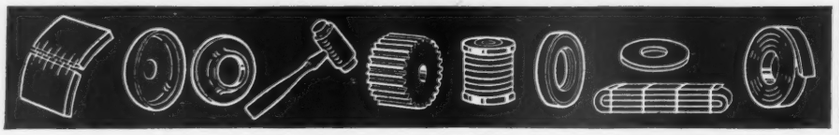


Chicago Rawhide pinions take all the wear when meshed with metal gears, still outwear either brass or iron. Made by a carefully developed process, from "Chicago Rawhide" the toughest of non-metallic gear material, these silent pinions will deliver as much power as metal gears and at the same time eliminate chatter, "grinding" and destructive vibration. Accurately cut in all sizes, types and pitches, they solve many difficult drive problems.

Write for Catalog

The Chicago Rawhide Mfg. Co.
1295 Elston Avenue Chicago, U. S. A.

New York Boston Philadelphia Pittsburgh Cleveland Cincinnati Detroit St. Louis



- *for a* Hundred Uses

Wherever you need a finely-atomized, evenly-distributed spray—you'll want Buffalo Non-Clogging Spray Nozzles. They give an exceedingly fine and uniform spray on pressures as low as 15 lbs. They have a removable cap which can be renewed if liquid handled is corrosive. They can be made of any material. They are non-clogging. Complete line of sizes in male and female types.

In addition to their use for hundreds of miscellaneous industrial services, Buffalo Spray Nozzles are standard equipment in the famous Buffalo Air Washers.

Write for bulletin listed below.

Buffalo Forge Company
171 Mortimer St., Buffalo, N. Y.

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" SPRAY NOZZLES

WRITE FOR BULLETIN 481

is started across the line. It drives a refrigerating machine and is automatically started and stopped. With all other motors stopped, readings of 466, 469, and 468 volts were obtained on the three phases, at the service switch. With the 40-hp. motor running the voltage was 430, 430, and 432, representing a drop of between 35 and 40 volts, at a current flow of 41 amp. per leg. When the large motor is started, all other motors being idle, the voltage drops to 356, 352, and 356, the current flow is 200 amp. per leg, and the motor sometimes fails to start the load. Recently the motor failed to start and was burned out because the relays did not operate. It was found that many of the bars in the outer squirrel cage were loose or broken. The rotor was repaired, but the high voltage drop still persists. This installation is supplied by a 50-kw., three-phase transformer and it has been suggested that this is too small. What is your opinion as to the cause of our trouble?

F.W.S.—San Diego, Calif.

WITH all motors stopped a voltage of 469, instead of the normal 440 volts, seems to indicate poor voltage regulation of the power lines. In this event the power company should be consulted.

There is a question as to whether the installation is supplied by a 50-kw., rather than a 50-kva. transformer, since transformers are rated on a kva. basis. A general rule is to allow 1 kva. per horse-power, which would mean that the installation should be supplied by a 75-kva. transformer. In some cases (depending upon starting conditions) it is necessary to install transformers of 100 to 125 per cent of rated motor capacity, if voltage is to be held up during starting.

Starting a 40-hp., double-squirrel cage, high-torque motor without a current-limit device will cause a heavy starting current and hence a large voltage drop, if the transformer capacity is not sufficient to hold up the voltage.

The starting current of this type of motor is above the limits set by most power companies. Since the starting torque varies as the square of the applied voltage, the torque at the low starting voltage mentioned would not be great enough to start the load.

P. LINDHOLM, *Newark, N. J.*

Trade Literature

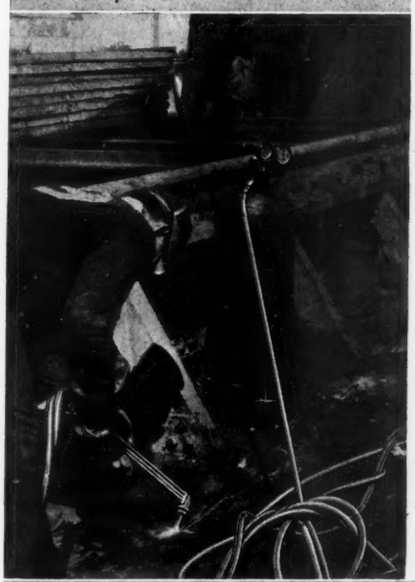
(Continued from editorial page 50)

stage volute Type F, and on two-stage volute Type U centrifugal pumps.—Worthington Pump & Machinery Corp., Harrison, N. J.

PYROMETERS — Bulletin, describing "Hold-Heet" pyrometer, portable or

What's INSIDE the hose you use?

FOR AIR Electric Air Hose *lasts longer* in any service because it resists abrasive wear, has high burst and never cracks or peels.



If by some magic X-ray you could accurately appraise the "insides" of each brand of hose you could tell in advance just which would last longest and cost least.

In Electric Hose, for example, you would find a lining of the highest quality of new, live rubber, specially compounded to resist your particular operating condition . . . A tightly braided re-enforcement of cabled cords nearly twice as strong as ordinary yarns . . . Each cord surrounded by rubber, leaving no weak points at which a crack may start and making it impossible for the hose to unwrap or unravel even if the cover should be worn away.

And speaking of the cover—that's where you would find the toughest rubber, so compounded that it won't crack from "ageing" or exposure and so resistant to wear that it lasts for months and years after ordinary hose has gone to the scrap pile.

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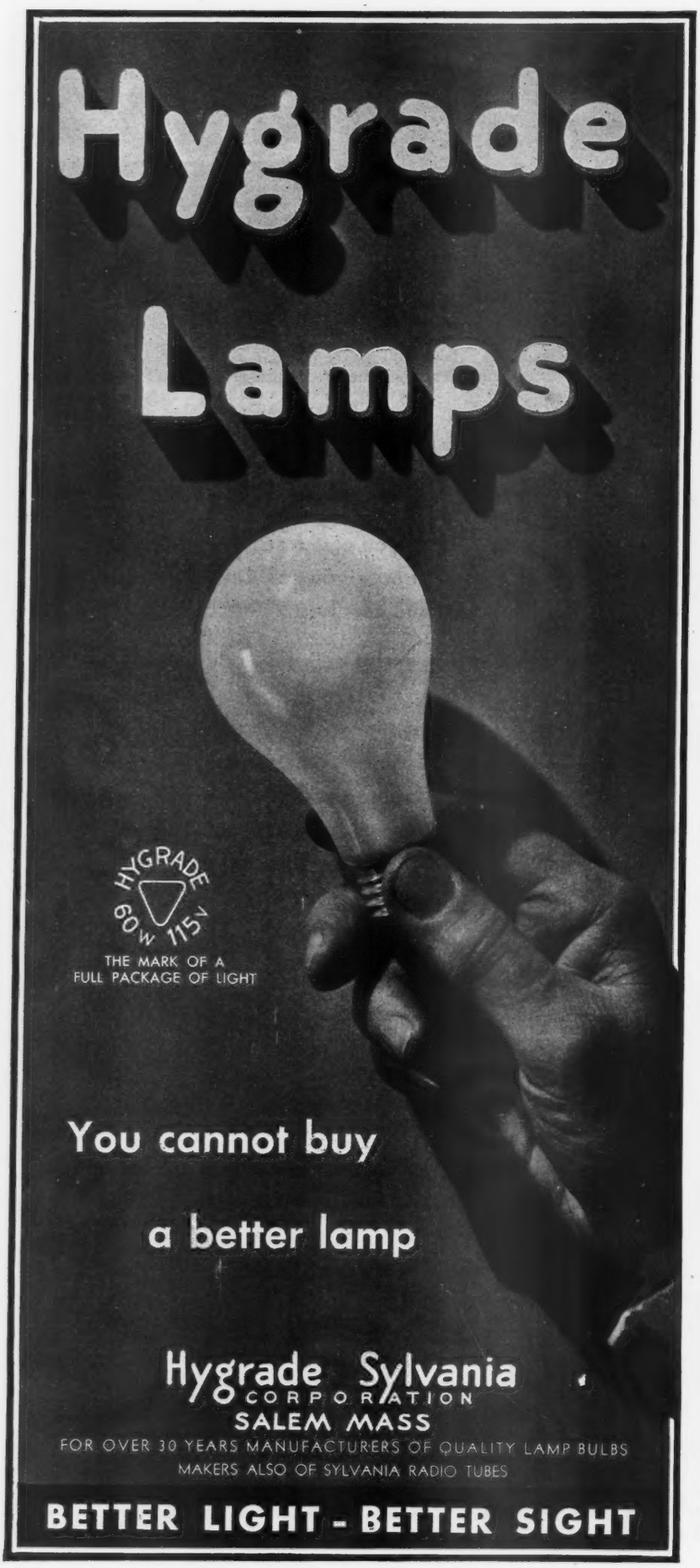

lance type.—Russell Electric Co., 340 West Huron St., Chicago.

ROOFS — Brochure, "What About Your Roofs?" and booklet, "3 Modern Developments That Give You the Ideal Roof Yet Save You Money."—Johns-Manville, 22 E. Fortieth St., New York.

SCREENS—Pamphlet No. 362, on Day Ro-Ball Stabilized Gyrating Screens. —The J. H. Day Co., Cincinnati.

STEEL — Bulletin, "Steels — Worthy of Your Best Designs."—Union Drawn Steel Co., Massillon, Ohio.

STEEL PLATES, SHAPES — Bulletin, describes service and supply of sheared plates, pressed shapes, and steel blanks made to order.—By-Products Steel Corp., Coatesville, Pa.

SWITCHES — Three bulletins: GEA-1327A, on indoor disconnecting switches with silver line-pressure contacts; GEA-1585-A, on high-voltage magnetic switches, oil-immersed type; GEA-1137-B, on indoor a.c. cubicle switchgear with manually or electrically operated breakers up to 15,000 volts, 2,000 amp.—General Electric Co., Schenectady, N. Y.

SWITCHGEAR — GEK-86, "Modern Money Saving." Describes G-E metal-inclosed switchgear.—General Electric Co., Schenectady, N. Y.

TAGS—Pocket-size portfolio containing samples of 22 grades of tag stock, table of standard tag sizes, 25 colors, also grades of wire and grades and colors of string.—Campbell Box & Tag Co., South Bend, Ind.

TURBINES—Three bulletins on turbines for mechanical drive; Types D-58, D-60 and DS-60.—General Electric Co., Schenectady, N. Y.

TWINE—Folder, describes "Pacord" twine for packing and shipping departments.—Tubbs Cordage Co., San Francisco.

WELDER—Bulletin No. 305, "General Specifications for Engine-Driven Type SA400 Shield Arc Welder"—Lincoln Electric Co., Cleveland.

WELDERS — GEA1440C, on General Electric arc welders.—General Electric Co., Schenectady, N. Y.

WELDING, CUTTING—Two booklets, "Precautions and Safe Practices in the Storage, Care, and Handling of Oxy-Acetylene Welding and Cutting Equipment," and "Recommended Practices for Gas Cutting of Structural Steel." —The Linde Air Products Co., 205 E. 42d St., New York.

WHEELS—Folders, "Metzgar Takes a Difficult Navy Job," and "Metzgar Floor Protective End-Wood Truck Wheels."—Metzgar Co., Grand Rapids.

Books

ELECTRIC POWER METERING

Archer E. Knowlton, Associate Editor, *Electrical World*, McGraw-Hill

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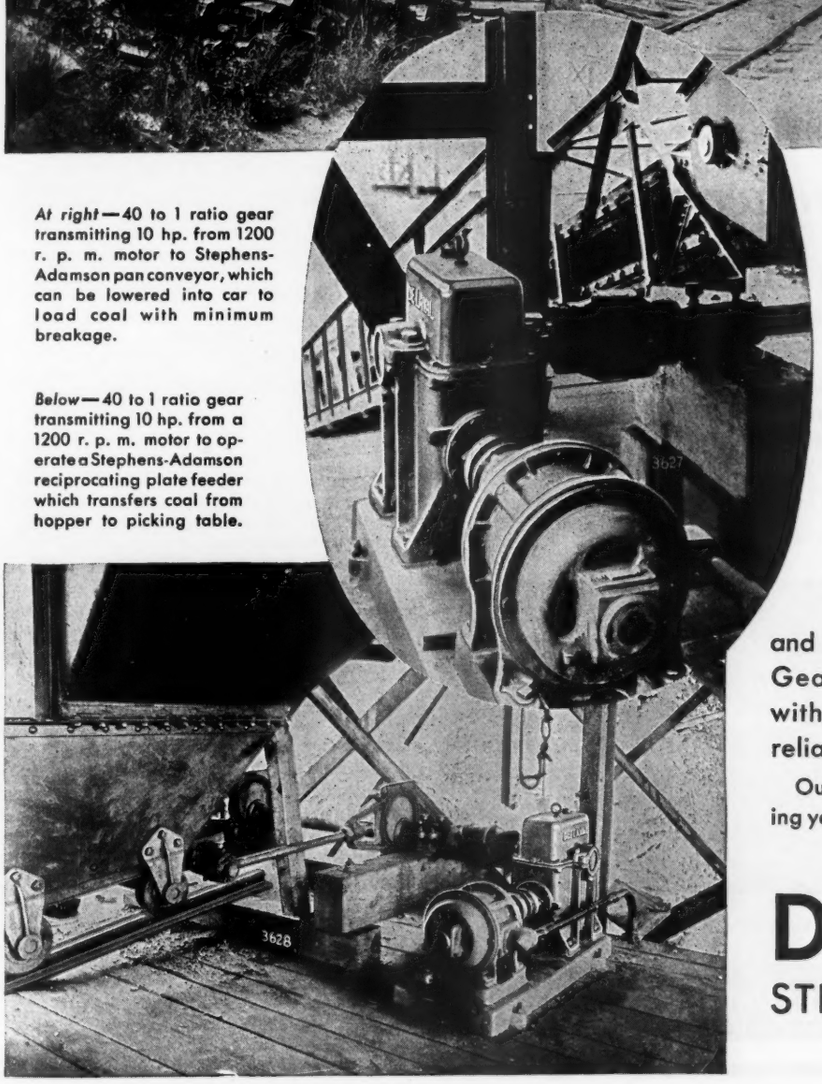
Below—40 to 1 ratio gear transmitting 10 hp. from a 1200 r. p. m. motor to operate a Stephens-Adamson reciprocating plate feeder which transfers coal from hopper to picking table.



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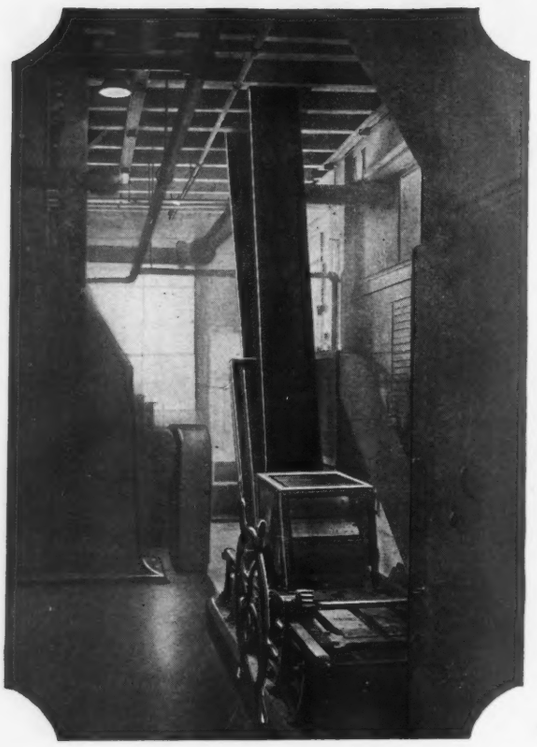

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THE FLEXIBLE BUDGET

John H. Williams, consulting management engineer. McGraw-Hill Book Co., Inc., 330 W. 42d St., New York. 279 pages, index. $2.50.

What the executive needs to know about a budget. A step by step account of how to set up a budget and how to make it work after it is set up.

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BUDGETING

Prior Sinclair, C.P.A., member of firm of Lybrand, Ross Bros. & Montgomery. The Ronald Press Co., 15 E. 26th St., New York. 438 pages, 160 figures. $5.

What a budget is. Its purpose. How to set it up. Specific application to sales, production, materials, purchase, labor, manufacturing expense, selling expense, advertising, plant and equipment, etc.

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On the Calendar

JANUARY

14-18, Society of Automotive Engineers, annual meeting, Detroit. John A. C. Warner, 29 W. 39th St., New York.

22-25, American Institute of Electrical Engineers, winter convention, New York. H. H. Henline, National Secretary, 29 W. 39th St., New York.

28-30, American Society of Heating and Ventilating Engineers, annual meeting, Buffalo. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

MARCH

5-8, Fifth Packaging Exposition, Palmer House, Chicago. Sponsored by American Management Association, Alvin E. Dodd, executive vice-president, 20 Vesey St., New York.

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Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* and *Maintenance Engineering.*

Factory and Industrial Management grew from consolidations, mergers, or absorptions involving the following publications: *The Engineering Magazine; Industrial Management; Factory, the Magazine of Management; Management Engineering; Administration; Management and Administration; Management and Administration in Manufacturing Industries; Manufacturing Industries.*

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